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RADIO NEWS

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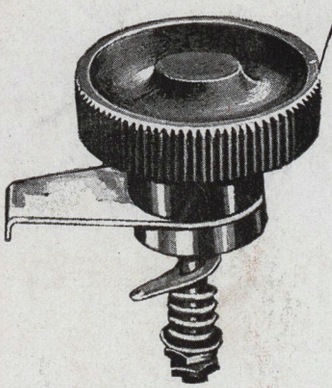

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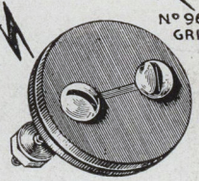

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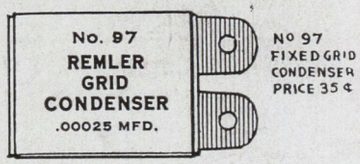

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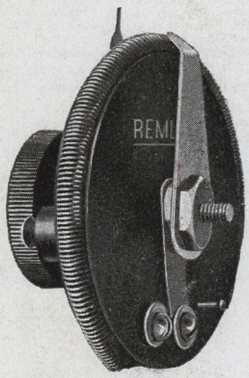

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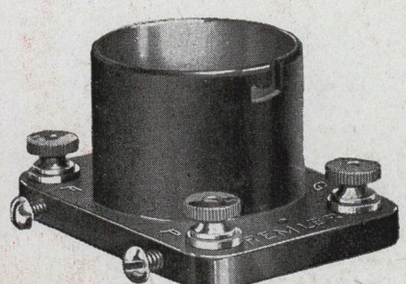

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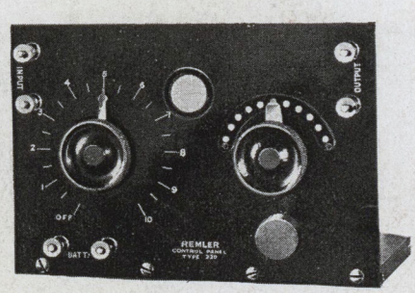

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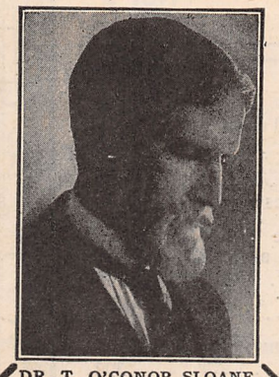

DR. T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.

Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

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READ WHAT ONE OF OUR STUDENTS SAYS:
(This Letter was Positively Unsolicited)

Phoenix, Ariz.,
Sept. 8, 1921.

Chemical Institute of N. Y.,
New York City.

Gentlemen:—Just about this time with most courses is the time when you feel like "cussing." I had struggled with several books in chemistry up to the time I started this course and was just about disgusted with them all. But say! this is just like reading some fascinating fiction story. Perhaps this is somewhat strong language but it expresses exactly what I mean. All of the frocks and frills have been left out and the bare facts are printed so an ordinary human can understand them without losing all the religion and bringing up he possesses. As a rule I am not much on bragging about anything but this is too good to keep to myself. I was planning on taking a course in Chemistry at High School this year but "they will have to get up pretty early in the morning" to produce a course that will even start to compare with this.

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(Signed) FOREST BAKER.

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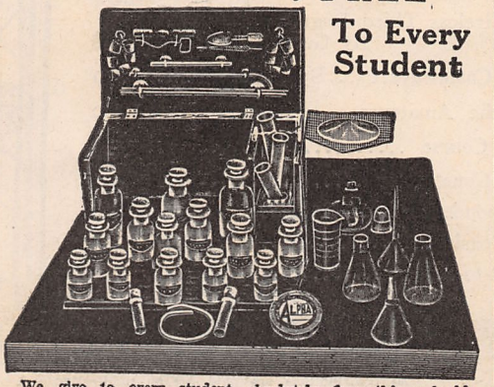

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R. N., Nov., '21.

RADIO NEWS

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TUNER, detector and 4-step amplifier for $85.00! Real quality at a new low-price level,—so arranged that you can invest a little at a time and yet get results right from the start.

That's what you get in Firco Midget Sets. You can start with just the Firco Tuner (150 to 1000 meters) for $15.00 and the Firco Detector for $11.00. You'll get results at once, better than you ever expected. Then you can add a little at a time till you get a powerful station like the one shown here.

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Read the price list below. Go to your radio dealer and let the sets speak of their quality for themselves. Then resolve to put every cent you invest in radio from now on, into Firco Apparatus,—where you get the most for your money.

Note: Six steps of amplification are made entirely practical, without howling or squealing, by the use of Firco Saco-Clad transformers. Saco-Clad 100% shielded amplifying transformers are also sold separately, in individual cartons for $5.00.

Hook a Vocaloud on to any amplifying combination of Firco Sets, or other apparatus, and get your signals QSA all over your house. No batteries, no adjustments, no extras. Station type (shown above) in solid mahogany cabinet, $30.00.

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John Firth & Company, Inc., 18 Broadway, New York

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Tuner, 35A	$15.00
Detector, 36A	11.00
Detector and One-Step Amplifier, 37A	24.00
Detector and Two-Step Amplifier, 38A	40.00
One-Step Amplifier, 39A	18.00
Two-Step Amplifier, 40A	30.00

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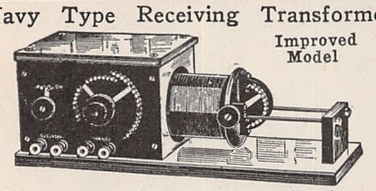
Our Chicago Store

Navy Type Receiving Transformer

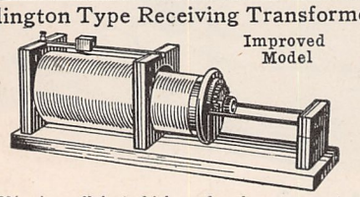
Improved Model



63R600—A very selective instrument for the more advanced stations. Primary inductance is controlled in steps by units and tens switches. Secondary has 12-point control. Has wave range up to 4,000 meters. Formica panels. Metal parts of brass polished nickel finish. Single silk covered windings. Mahogany finished wood work. Base is 18 inches long, 6½ inches wide. Shipping weight, 25 lbs. Price **$17.50**

Arlington Type Receiving Transformer

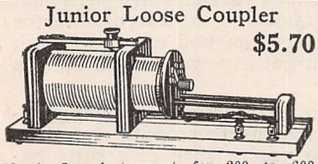
Improved Model



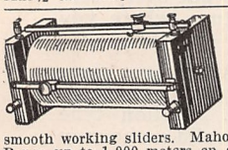
63R601—An efficient high-grade, long wave tuner. Has same winding as our Navy type. Will receive all government time stations such as Arlington and Key West. Works up to 4,000 meters. Primary controlled by slider. Secondary inductance varied by a 12-point switch mounted on Formica, silk covered wire windings. Brass metal parts polished and lacquered. Mahogany finished wood work. Base, 18 inches long, 6 inches wide. Shipping weight, 14 pounds. Price **$7.70**

Junior Loose Coupler

$5.70



63R5103—A fine instrument for 200 to 600 meter work. Primary controlled with slider, secondary by 5 point switch. Metal parts brass, polished and lacquered. Woodwork mahogany finish. Base 12x3½ in. Ship. wt. 6 pounds. Price..... **$5.70**



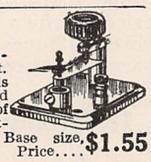
Two Slide Tuning Coil

63R5104 — Machine spaced enameled copper wire winding. Non-shrinkable tube. Control is by means of two smooth working sliders. Mahogany finished end pieces. Range up to 1,000 meters on average antenna. Length, 8¾ in. Ship. wt. 4 pounds. Price.. **$3.45**

Loading Coil

63R5105—Essentially the same as two slider tuning coil, but has only one slider. Will add about 300M range to any set. Shipping weight, 3 lbs. Price **$3.20**

Universal Detector

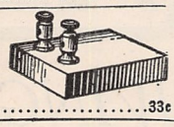


63R5304—A detector of correct construction. Permanent adjustment. Galena, silicon and other minerals can be used. Moulded base and adjustment knob. Metal parts of brass, polished nickel finish. Tested piece of silicon included. Base size, 2½x3½ in. Ship. weight., 1 lb. Price.... **$1.55**

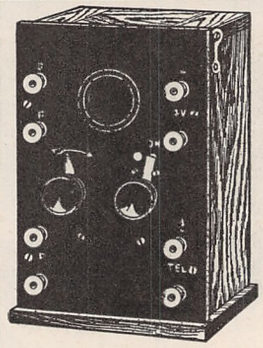
Murdock Detector Stand

63R5302—A good low priced detector stand. Will do very satisfactory work. Moulded black composition base. Adjustable cup and contact. Nickel plated binding posts. No crystals included. Size, 2⅝x1½x2 in. Shipping weight, 4 oz. Price **65c**

Mica Grid Condenser



For use in grid circuit of vacuum tube. Cap., .0005 M.F. Weight, 8 and 2 oz.
63R5330—Mounted in mahogany base. Price.....65c
63R5331—Unmounted. Price.....33c



Vacuum Tube Control Detector Cabinet

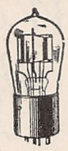
An efficiently arranged fine looking detector cabinet. The best value and the highest grade instrument we have found. Standard V.T. base mounted on back of panel. V.T. may be observed through window. Filament control rheostat. Grid condenser. Nickel plated binding posts with marked connections. Fine quality cabinet, weathered oak finish, hinged at top so that interior is easily accessible. Bakelite Panel size 7½x5¼ in. Shipping weight, 6 pounds.
63R5170—Detector cabinet **$11.65**

Vacuum Tube Amplifier Cabinet

Arranged to work in conjunction with any V.T. detector cabinet. Being of the same size and construction as our special detector cabinet the two make a desirable combination. Standard V.T. base mounted on back of panel. V.T. may be observed through window. Filament control rheostat. Improved amplification transformer. Nickel plated binding posts with marked connections. Fine quality cabinet, weathered oak finish, hinged at top so that interior is easily accessible. Bakelite Panel size 7½x5¼ in. Ship. wt., 7 lbs.
63R5172—Amplifier cabinet **$15.95**

Radiotron Vacuum Tube Detector

63R5194—This is a "soft" tube especially suited for detector use and is also an excellent audion frequency amplifier. It produces excellent results in regenerative circuits. Has the familiar hissing point and low B battery potential requirements. Standard four-prong mounting. Shipping weight, 1 lb Price **$4.65**



63R5620—4000 ohm potentiometer graphite. Often used with soft vacuum tubes. Price..... **69c**

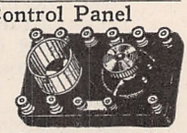
Improved V. T. Socket

63R5343—Improved long flat spring contacts insure positive contact on any standard tube base prongs. Glossy black composition base. Nickeled tube. Marked screw connections. May be used and wired in any position. Shipping weight, 8 ounces. Price **95c**

Grid Leak

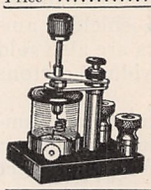
63R5341—Pencil mark type variable high resistance. When shunted across, stopping condenser keeps potential of grid of such a value, that paralyzation is prevented, and most efficient results are obtained. Ready to mount on panel. Ship. wt., 3 oz. Price..... **56c**

Vacuum Tube Control Panel



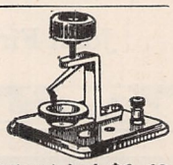
63R5108—A compact, handy V.T. panel. Standard socket, rheostat, grid condenser, grid leak and binding posts all mounted on moulded bakelite panel. Metal parts polished nickel finish. A high grade, inexpensive instrument that will do as good work as the highest price cabinet. Base size, 3⅛x5 in. Shipping weight, 2¼ lbs. Price **$5.65**

Weatherproof Detector



63R5303—Very rugged. Perfect easy adjustment. Phosphor bronze contact spring can be set and locked in any position. A piece of tested galena set in Wood's metal is mounted inside dust and moisture proof enclosed glass cylinder. Formica base, 2x2x⅜ in Ship. wt. 1 lb. Price **$2.45**

Standard Galena Detector



63R5305—A popular detector. Tested piece of galena is mounted in cup which can be rotated. Crystal contact of phosphor bronze wire coiled and pointed and soldered on flat spring. Very fine adjustment obtainable with screw. Moulded base and adjustment knob. Base, size 3x3 in. Ship. wt., 1¼ lbs. Price. **$1.43**

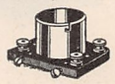
Detector Crystals

Genuine Arlington Tested Minerals. Absolutely the best crystals that can be purchased for any price. All are thoroughly tested and guaranteed. Extremely sensitive. Packed separately in sealed boxes. Shipping weight about 3 ounces. **22c**
63R5320—Supersensitive Galena Per crystal...
63R5322—Supersensitive Silicon, per crystal.....22c
63R5324—"Radiocite." Per crystal.....18c

Radiotron Vacuum Tube Amplifier Oscillator

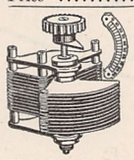
63R5192—A high vacuum amplifier and detector. Requires no critical adjustment. Designed for amplification and undamped wave reception by the regenerative method. May be used singly for receiving continuous waves or in cascade as a two or more step amplifier. Shipping weight, 1 lb. Price..... **$6.25**

Socket for Vacuum Tube



63R5342—Socket is mounted on bakelite sheet. Four binding posts for connections. Screw holes for flat mounting, screws in side of base for panel mounting, permitting either upright or vertical position of tube. Shipping weight, 8 ounces. Price **$1.35**

Variable Condenser for Panel Mounting

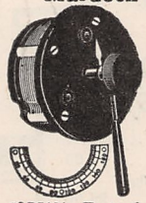


63R5173—The best value in high grade variable condensers. Rugged, durable construction. 13 aluminum stationary plates, 12 rotary plates. Overall dimensions 4⅝ in. high, 3¼ in. wide, 3 in. long. Bakelite knob. Etched scale. Cap., .0005 M. F. Shipping weight, 1 pound. Price **$6.25**

Murdock Variable Condenser,, Enclosed Type

63R5175—Murdock No. 367. Polished black composition top and bottom with transparent enclosing cylinder, 22 stationary plates, 21 movable plates. Cap., .001 M.F. Diam., 3⅞ in. Height, 3¼ in. Binding posts and arrow pointer are nickel plated. Degree engraved scale. Shipping weight, 2¼ lbs. Price **$4.20**
63R5177—Murdock 368. Same as above but has 12 stationary plates and 11 movable. Capacity, .0005 M.F. Shipping weight, 1½ pounds. Price **$3.78**

Murdock Panel Type Variable Condenser



63R5179—Twenty-three plate .0005 M.F. capacity. Ruggedly assembled for panel mounting. Complete with mounting screws, knob, pointer, engraved 180 degree scale and anti-capacity handle. ¼ in. shaft. Any standard knob or dial may be used. Requires space 3⅛ in. wide; 2 in. deep for mounting. Shipping weight 1½ lbs. Murdock No. 3681. Price **$3.38**
63R5181—Forty-three plates. Capacity .001 M.F. Complete as above. Requires space 3⅜ in. wide, 2¾ in. deep for mounting. Ship. wt., 2½ lbs. Murdock No. 3661. Price..... **$4.10**

Knocked Down Variable Condenser

Furnished complete but unassembled. Intended for panel mounting and are complete with scale pointer and knob. Formica tops and bases. Shipping weight, 1¼ lbs.
63R5183—Capacity, .001 M.F. 41 plates. Price **$3.20**
63R5185—Capacity, .0005 M.F. 21 plates. Price **$2.25**

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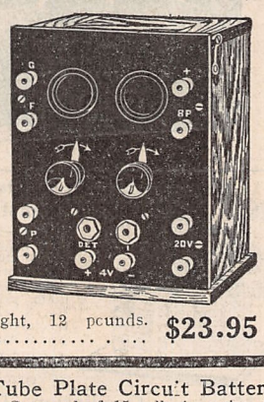
Our Kansas City Store

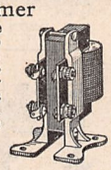
Combined Detector and Amplifier



This instrument in connection with a set of inductance coils, two variable condensers, batteries and a good aerial will permit of the reception of all classes of radio signals over an extremely broad range. Used in conjunction with our Regenerative set you have a receiving outfit that can only be excelled by adding additional stages of amplification. Detector and amplification tubes mounted inside of cabinet and are provided with rheostat control. Detector provided with grid condenser. High efficiency amplification transformer between detector and amplifier circuit. Jacks are wired in detector and amplifier circuit and a plug supplied for phones permitting use of detector or amplifier as desired. Dull finish bakelite panel, 7½ in. high, 6⅜ in. wide. High grade weathered oak finish cabinet with hinged top, making interior easily accessible. Binding post connections for batteries and couplers. No tubes, batteries or phones included. Brass metal parts. Binding posts oxidized finish. Shipping weight, 12 pounds.

63R612—Price **$23.95**

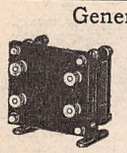
Amplifying Transformer



63R5140—Will positively increase the strength of incoming signals up to twenty times the original audibility. Scientifically designed to work with the vacuum tubes supplied for amateur use. One of the best devices in its class. It is of the iron core type and is supplied with binding posts and lugs for mounting. Height, 2½ in. Shipping weight, 1 pound. Price **$3.75**

63R5141—Same as above but not mounted. Price **$2.95**

General Radio Amplifying Transformer



We believe this to be the most efficient, best designed and best constructed amplification transformer on the market. Panel is of bakelite. Binding posts are polished nickel finish. Supports are black enamel finish. Size, 2¾x2½x2¼ in. Ship. wt., 1 lb.

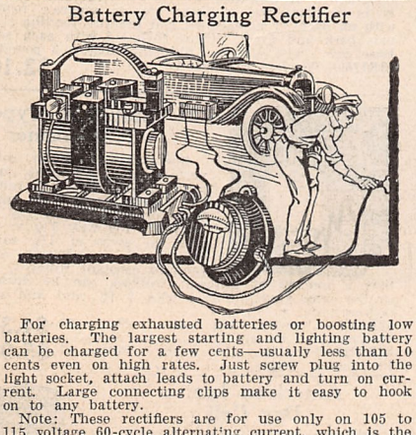
63R5188—As illustrated. Price **$6.75**

63R5190—Same, not mounted, but with supports for mounting. Price $4.95

"A" Storage Battery

63R498—Six volt, 60 amp. hour storage batteries for filament circuit. This is a high grade battery and will give long, satisfactory service. Weight, 30 lbs. Price **$14.85**

Battery Charging Rectifier



For charging exhausted batteries or boosting low batteries. The largest starting and lighting battery can be charged for a few cents—usually less than 10 cents even on high rates. Just screw plug into the light socket, attach leads to battery and turn on current. Large connecting clips make it easy to hook on to any battery.

Note: These rectifiers are for use only on 105 to 115 voltage 60-cycle alternating current, which is the usual city lighting current. Will not work on direct current nor 25-cycle currents.

Prices include 10-foot connecting cord with socket plug, ammeter, battery leads and two clips. Length, 7 inches, width, 5 inches, height 7 inches.

63R6193—Charges 6-volt battery at 7 amperes rate. Shipping weight, 10 pounds. Price delivered each **$13.95**

63R6191—Charges 12-volt battery at average rate of 5 amperes. Shipping weight, 14 pounds. Price delivered, each **$13.95**

Vacuum Tube Plate Circuit Battery

Composed of 15 cells in series—22.5 volts. Each cell separately insulated and the whole unit compactly assembled and sealed together. Flexible leads from end cells. Polarity plainly marked.

63R5618—Signal corps standard size, 3¼x2x2½ in. Shipping weight, 2 lbs. Price **98c**

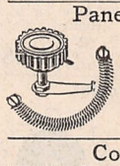
63R5621—Navy standard, size, 6¼x4x3 in. Shipping weight, 5 lbs. Price $1.65

Porcelain Base Rheostat

German silver winding on threaded fibre strip imbedded in porcelain base. Smooth easy action. Moulded knobs, 1⅛ in. diameter. Resistance, 11 ohms. Capacity, 3 amperes. Diameter. 4 inches. Shipping weight, 1½ lbs.

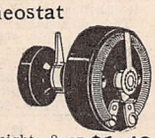
63R5313—Front mounted. Price **88c**

Panel Mounting Rheostat



63R5316—An ideal rheostat for filament control. Enameled resistance wire wound on bakelite form. Resistance 5 ohms. Capacity 2 amperes. Complete with knob, shaft, nuts and pointer. Ship. wt., 3 oz. Each **$1.05**

Combination Rheostat



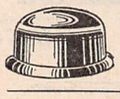
63R5318—For either panel or table mounting. Especially desirable for panel mounting. Requires space only 2½ in. diam. and ⅞ in. deep. Moulded condensite base and knob. Smooth operation. Easy connecting and assembling. Resistance 6 ohm. Capacity 1½ amperes. Shipping weight, 8 oz. Price **$1.42**

Unmounted Honeycomb Inductance Coils

High grade efficient inductance coils at attractive prices. Claimed by many users to be the best on the market. Made firm by varnish impregnation. Shipping weight, 4 to 16 oz. Wave length is in meters with .001 M.F. condenser. Not mounted.

Article Number	Number Turns	Approximate Wave Length Range	Price
63R5470	25	130— 250	39c
63R5471	35	180— 450	42c
63R5472	50	250— 700	49c
63R5473	75	400— 900	55c
63R5474	100	500— 1,000	59c
63R5475	150	600— 1,200	62c
63R5476	200	1,000— 2,500	65c
63R5477	300	1,500— 4,500	73c
63R5478	400	2,000— 6,000	78c
63R5479	600	4,000—10,000	98c
63R5480	1,000	8,000—15,000	$1.38
63R5481	1,250	10,000—20,000	1.72
63R5482	1,500	16,000—25,000	2.17

Test Buzzers



63R5345—Watch case buzzer. Operates on one dry cell. Nickel plated cover and base. 1 inch high, 2⅛ inches diameter. Ship. wt., 8 oz. Price..... **85c**

Receiver Cord

63R5385—Double receiver green mercerized cord, 6 feet long, for use with any standard receiver. Price..70c

Century Buzzer

64R5346—Used by the Army and Navy and commercial wireless stations. For adjusting crystal detector. Operates on one or two dry cells. Base is hard rubber with black enameled brass cover. Two thumb screws provide for adjustment of the armature to regulate the tone to desired pitch. Genuine Platinum Contacts. Diameter of base, 2 in. Ship. wt., 6 oz. Price **$1.65**

Test Buzzer Push Button

64R5137—For use with test buzzer. Nickel rim with pearl center. Held firmly in ⅝ inch hole by small spring clips. Ship. wt., 4 oz. Price **25c**

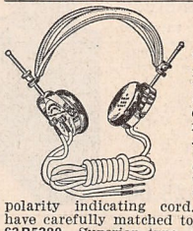
Murdock No. 55 Head Sets

These sets have given excellent service to thousands of users. Thin extra responsive diaphrams, fine quality permanent steel magnets, enameled copper wire windings. Nickel silver adjustable headband, complete with 5-foot cord. Ship. wt., 1½ lbs.

63R5370—Double set, 2000 ohms (total). Price **$4.25**

63R5371—Double set, 3000 ohms (total)..... 5.20

Brandes High Grade Receivers



The Brandes line of receivers is the very finest. They are used throughout the world and are famous for their excellent workmanship, durability and extreme sensitiveness. All have the new Brandes type head band, which is comfortable, easily adjusted, very light and will not catch the hair. Fitted with 6-ft. polarity indicating cord. The phones of each set have carefully matched tones. Ship. wt., 2 lbs. per set.

63R5380—Superior type, total res. 2000 ohms. Complete. Wt., 14 oz. Price..... **$7.70**

63R5381—Transatlantic type, total res. 2800 ohms. Complete. Wt., 11 oz. Price..... $11.20

63R5382—Navy type, total res. 3000 ohms. Very sensitive. Complete. Wt., 9 oz. Price..... $13.10

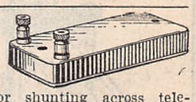
Learner's Head Set

63R5383 — Scientifically constructed for radio use. Should not be confused with ordinary telephone receivers sometimes furnished. These sets are just the thing for those who wish a low priced sensitive radio head set. Res. 1000 ohms. Ship. wt., about 1¼ lbs. Price—$2.45

Watch Case Receiver

63R5384—Regulation watch case type telephone receiver. Moulded composition case. Bipolar. Resistance, 80 ohms Ship. wt., 12 oz. Price, each.. **$1.05**

Fixed Receiver Condenser



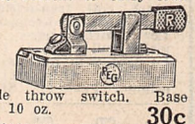
A necessity on every receiving set. Used as "stopping" condenser or for shunting across telephones. Moulded composition bases. Nickel plated binding posts. Ship. wt., about 8 oz.

63R5362—Capacity, .01 M. F. Price..... **85c**

63R5364—Capacity, .005 M. F. Price..... 65c

Knife Switches

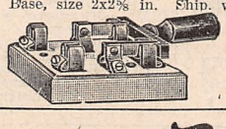
Porcelain base switches. Contacts and blades made of heavy copper. Intended for low voltage currents, but can be used on 125 volt current to carry load not over 15 amperes.



63R2684—Single pole single throw switch. Base, size, 1⅜x3⅛ in. Ship. wt., 6 oz. Each **22c**

63R2686—Single pole, double throw switch. Base size, 1⅜x3⅞ in. Ship. wt., 10 oz. Each **30c**

63R2687—Double pole. Single throw switch. Base, size 2x2⅝ in. Ship. wt., 10 oz. Each.. **39c**



63R2689—Double pole. Double throw switch. Base, size, 2⅝x4 in. Ship. wt., 1 lb. Each..... **48c**

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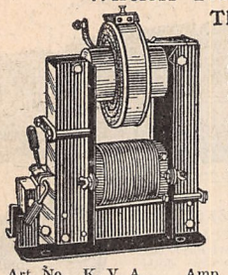
Wireless Transformers

Thordarson Type R



For use on 108 to 115-volt alternating current, 60 cycles. Generally accepted as the standard transformer for amateur transmitting. Provided with adjustable magnetic leakage gap which controls primary input giving a wide range of amperage and permitting easy adjustment to point of resonance. No impedance or choke coil necessary in primary circuit. Ship. wt., 35 and 55 lbs.

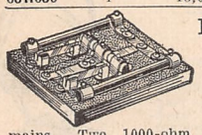
Art. No.	K. V. A.	Amp.	Sec. Volt	Price
63R630	½	1 to 6	10,000	$21.00
63R632	1	2½ to 14	25,000	38.00

Thordarson Type R. S. Transformer

This type differs from the well known model shown above only in that it does not have the adjustable magnetic shunt. All other features of sturdy, compact construction and correct electrical characteristics are the same. For use on 105 to 120 volt 60 cycle alternating current.

Art. No.	K. V. A.	Sec. Volts	Ship. wt.	Price
63R633	¼	3,000	15 lbs.	$10 00
63R634	½	10,000	25 lbs.	19 00
63R635	1	15,000	35 lbs.	28.50

Kick Back Preventer



63R5358—Prevents high frequency surges from discharging back into power line. A necessity when power transformer is supplied from city mains. Two 1000-ohm resistance rods. Mahogany finished base. Connections of strip copper. Ship. wt., 4 lbs. Price..... $4.80

Variable Transmitting Condenser—Oil Immersed

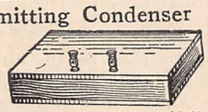
63R620—An oil immersed variable condenser for use with all makes of transformers up to 1 K. W., 25,000 volts. Phenol fibre dielectric, corrugated aluminum separators allow circulation of oil to keep down heating. Flat aluminum sheet electrodes with rounded corners. Variable in ten steps of .0009 M. F. each from .0018 M. F. to .009 M. F. Especially designed to prevent corona losses and brush discharge. Oil included. Ship. wt., 35 lbs. Price..... $25.00

Wireless Spark Coils

For use on dry cells or storage batteries. Properly adjusted the half- inch coil has a sending range of from 2 to 5 miles, the one-inch coil 5 to 10 miles. Ship. wt., 6 and 8 lbs.

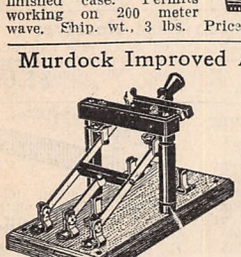
63R5126 — Half inch coil..... $3.65
63R5127—1 inch coil... 5.95

Spark Coil Transmitting Condenser



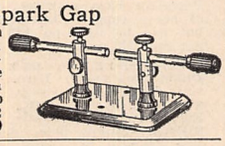
63R5348—Designed for use with spark coil sets, dielectric of 5—size, 5x7 photo plates. Mahogany finished case. Permits working on 200 meter wave. Ship. wt., 3 lbs. Price..... $1.48

Murdock Improved Antenna Switch



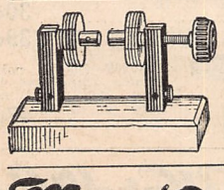
63R5113 — A large, sturdy, well built "change over" switch suitable for use on sets up to 1 K. W. Mahogany finish base. Improved support, copper blades. Fitted with third blade to disconnect receiver when sending. Ship. wt., 2½ pounds. Price..... $4.30

Zinc Spark Gap



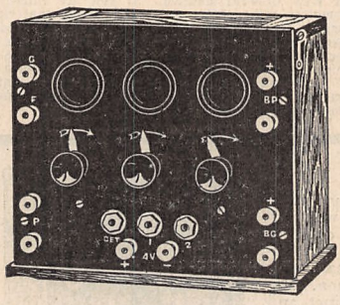
63R5350—For use with spark coil transmitters. Base is moulded composition. Metal parts are plated and polished. Can be used with coils up to 4 inches. Ship. wt., 2 pounds. Price..... $1.10

Radiator Spark Gap



63R5351—Micrometer adjustment. Electrodes of zinc. Cooling vanes aluminum. Metal parts nickel plated. Base glazed porcelain. Will handle over 1 K. W. Weight, 2 lbs..... $2.30

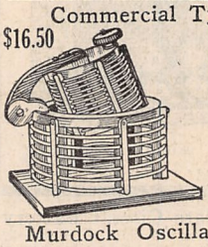
Combined Detector and Two Stage Amplifier



This instrument with the proper accessory instruments has the broadest possible range. So sensitive is it that even with an indoor aerial such as our loop antenna 63R650 messages may be received from stations hundreds of miles distant. Combined with our Regenerative set and two variable condensers and the proper couplers and loaders with a good outdoor aerial, its range is increased to equal the best commercial stations. Has one detector and two amplifier circuits. Standard tube sockets, grid condenser in detector circuit, two amplification transformers, three jacks and one plug so that any desired circuit may be used. Bakelite panel 7½ in. high, 8¾ in. wide. High grade weathered oak finish cabinet with hinged top making interior easily accessible. Binding post connections for batteries and couplers. Binding posts black oxidized finish. No tubes, batteries or phones included. Shipping weight, 18 lbs.
63R615—Price $33.50

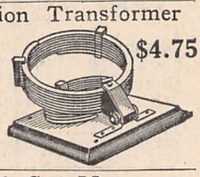
Commercial Type Oscillation Transformer

$16.50



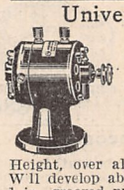
63R648—Designed to give wave ranges both above and below 200 meters. Solid copper windings on "Formica" supports 10½ in. diam. primary of six turns No. 3 wire 6½ in. diam., secondary of twelve turns No. 5 wire. Mahogany finished woodwork. Two helix clips included. Ship. wt., 26 pounds. Price..$16.50

Murdock Oscillation Transformer



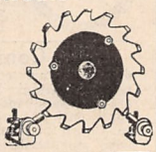
63R5155—Permits sharp tuning on 200 meter wave. Can be used on sets up to 1 K. W. Primary and Secondary windings of edgewise wound copper ribbon. Coupling varied by hinge. Shipping weight, 8 lbs. Price $4.75

Universal Spark Gap Motor



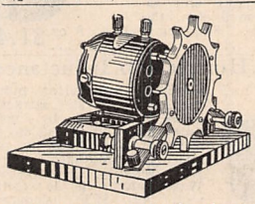
63R5624—A rugged high grade motor for spark gaps, running sewing machines, fans, small lathes, buffers, emery wheels, etc. Running idle will make 8,000 R.P.M. Will make about 4,500 R.P.M. with electrode shown below. Will operate on 100-125-volt A. C. or D. C. current. Black enamel finish. Height, over all, 5½ in. ¼ in. shaft, extends ⅞ in. Will develop about 1/20 H. P. Supplied with 1-in. grooved pulley. Ship. wt., 8 lbs. Price.. $9.50

Spark Gap Electrodes



63R5625—Saw tooth rotor, 5⅜ in. diam., of machined cast aluminum with bakelite center and brass bushing to fit ¼-inch shaft. Two adjustable stationary electrodes. This set together with universal motor listed above, mounted on a substantial base will make a high grade rotary spark gap. Ship. wt. 1½ lbs. Price, set..... $4.50

Improved Model Rotary Spark Gap



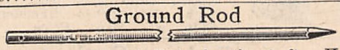
Flat pure copper electrodes avoid pitting. Width of break adjustable. Strong breeze generated by rotary electrode quickly quenches spark, thereby allowing transmission of wave of low decrement. All conducting metal mounted on Formica. Easily handles 40,000 volts without endangering motor windings. Constant steady speed. Ship. wt., 10 lbs. Shipped from stock at Chicago.

263R5142—½ K. W. size. 1/20 H.P. Universal motor. For 108 to 115-volt current. Speed 4,000 R.P.M. Price..... $14.80
263R5143—1 K. W. size. 1/12 H.P. Universal motor For 108 to 115-volt current. Speed 5,000 R.P.M. Price..... $18.95

Ground Switch

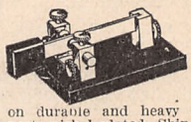
63R5359—600 volt, 100 ampere double throw single-pole switch on insulating base. For grounding aerial when not in use. Ground wire should be 4 gauge. Ship. wt., 5 lbs. Price..... $3.78

Ground Rod



63R1031—Iron Ground Rod; length, 6 ft. Heavily galvanized. A ground rod is necessary with every Radio outfit to insure a perfect ground contact. Shipping weight, 4 lbs. Price each... 43c

Double Action Wireless Key

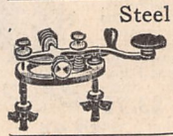


63R5356—Double action which makes for speed. Will improve your sending and lends individuality. Large standards, formica knob, heavy silver contacts suitable for use up to 2 K. W. Mounted on durable and heavy formica base. Metal parts nickel plated. Ship. wt., 1¾ lbs. Price.. $4.65

Standard Wireless Key

63R5352—A high grade key made of heavy lacquered brass. Large hardened contact points. Ship wt., 1 lb. Price. $3.48

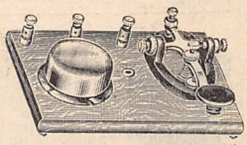
Steel Lever Keys



Shipping wt., 14 oz.

63R1739—Leg Key with legs to go through table or desk. Price, each.... $1.85
63R1741—Legless Key to screw to top of table or desk. Price each $1.97

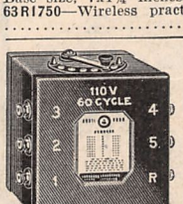
Wireless Practice Set



Beginners! Learn the Code!

Anyone learning wireless must know the code. Without it, it is impossible to understand the signals. Send for a wireless practice set and see how easy it is to learn the code. Set consists of a key and buzzer mounted on a polished wood base. Buzzer reproduces accurately the high pitched sounds of wireless stations. Connect a dry battery to the binding posts on the set by means of a short piece of wire, press the handle of the key and buzzing sound will be produced. In a very short time your ear will become accustomed to the various combinations of dots and dashes representing different letters and numerals. Practice until you can understand the signals at the speed sent by average stations and you have completed the most difficult part of wireless telegraphy. A very good way to learn the code quickly is to place two of these sets in separate rooms with an operator at each set and practice sending signals back and forth. Chart included with each set. Base size, 7x4¾ inches. Shipping weight, 3 pounds.
63R1750—Wireless practice set. $2.10

Standard Type Transformer



Operates only when connected onto alternating current line of 100 to 125 volts, 60 to 133 cycles. 100 watt Transformer produces 1½ to 24 volts, 150 watt 1½ to 30 volts in steps of 1½ volts each, and in addition can produce constant voltages, so that a number of different voltages can be drawn at the same time. Fitted with 7 ft. cord and attaching plug.

63R1697—Capacity, 100 watts. Ship. wt., 10 pounds. Price..... $4.35
63R1699—Capacity, 150 watts. Ship. wt., 13 pounds. Price..... $5.95

American Ignitor Dry Cell

We guarantee that these batteries will reach you fresh and will give you all the service you have a right to expect of the best 2½ by 6-inch dry cell made. Designed especially for heavy duty work. For ignition work on gas engines, automobiles, motor boats, etc. Average weight, 2 pounds. Size, 2½ by 6 inches. Average initial amperage, 25 to 30 amperes.

63R2501— Price, each..... 37c
63R2502—Price, per dozen..... $4 30

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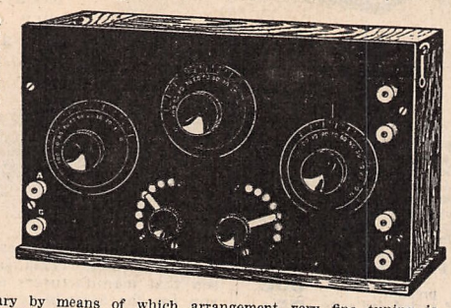
Short Wave Long Distance Regenerator Receiver $31.50

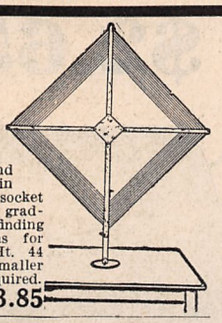


This instrument makes possible the reception of messages to which other types of apparatus will not respond. The range is from 180 to 600 meters and by the addition of external loaders, such as the inductance coils listed on the opposite page, this range may be raised as desired. Properly handled, signals may be read from stations at extreme distances or through heavy static and interference. The antenna and closed circuits are inductively coupled and the coupling is variable. Regeneration is obtained by tuning both the grid and plate circuits to resonance with the incoming signal. Highest efficiency and amplifications are obtained by reducing capacity and resistance in circuits to absolute minimum and best regenerative effects are secured by use of properly designed variometers.

The inductive coupler consists of a primary, the inductance of which is varied by two seven point switches, and a rotating secondary by means of which arrangement very fine tuning is possible. Coupler and both grid and plate circuit variometers are fitted with high grade knobs and indicating dials. A very compact and easily portable instrument. Graduated bakelite panel size 7¼ x 13¾ in. Fine cabinet weathered oak finish, 5 inches deep. Metal parts brass, black oxidized finish. Ship. wt., 26 lbs.

63R610—Regenerative Receiver. Price.....$31.50

Loop Antenna



63R651—Will receive messages from stations 300 miles distant, and much farther under favorable conditions. Wave length, 175 to 300 meters. Comes knocked down complete with brass plates and screws for holding arms in position, brass disc and socket for mounting on table, graduated dial for direction finding and complete instructions for assembling and using. Ht. 44 in. 100 ft. of No. 14 or smaller bare copper wire is required. Ship. wt., 5 lbs. Price without wire $3.85

Indicating Dials and Knobs

Marconi — New Gov. — Reg. — Ideal

Made of moulded black composition. Edges of dials are beveled, radial lines and figures are engraved in and filled with contrasting brilliant white enamel 3/16 in. thick.

63R5655—3-inch Dial only. Price..... 39c
63R5657—3-inch dial with bakelite knob. Price 89c
63R5659—3⅞-in. dial only. Price.....85c
63R5661—3⅞-in. dial with 1⅝ in. government bakelite knob. Price.....$1.31

Black Composition Knobs

Ship. wt., 4 oz. each. Per doz. 1¼ lbs.

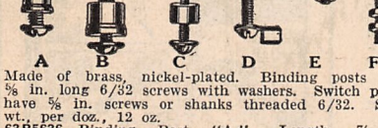
63R5665—Marconi style, 1¼ in. diam. Hole for 3/16 in. rod. Each,12c. Per dozen.....$1.10
63R5667—Marconi style 2⅛ in. diam. Hole for 3/16 in. rod. Each, 21c. Per dozen.....$2.40

New government style. Has brass bushing for 10/32 thread and two holes for stay pins.

63R5669—Diam. 1 inch. Each 11c. Dozen.....$1.25
63R5671—Diam. 1-5/16 inch. Each.....14c
Dozen $1.55

63R5673—Regulation 1½-inch knob with 8/32 bushing. Each .....11c Dozen.....$1.08
63R5675—Ideal 1¾-inch knob metal bushing for 3/16 rod with set screw. Each.....20c
Dozen $2.25

Binding Posts and Switch Points



A B C D E F

Made of brass, nickel-plated. Binding posts have ⅝ in. long 6/32 screws with washers. Switch points have ⅝ in. screws or shanks threaded 6/32. Ship. wt., per doz., 12 oz.

63R5636—Binding Post "A," Length, ⅞ in. Each .....9c Dozen 95c
63R5640—Binding Post "B," Length 1-3/16 in. Each .....12c Dozen.....$1.28
63R5644—Binding Post "C." With bakelite knob. Each.....12c Dozen.....$1.38
63R5646—Switch Point "D," ¼x¼ head with soldering lug. Per dozen.....38c
63R5648—Switch Point "E." Head ¼ in. diam. ⅛ in. high with 2 nuts. Dozen.....45c
63R5650—Switch Point "F." Head ¼ x ¼ with two nuts. Dozen 48c

Grade M Formica Panels

Black sheets. Both sides polished. Waterproof, strong, lasting. Ship. wt., 2 to 8 lbs. Size given is in inches. $0.69

63R5688— 7x 9x1/8		
63R5690—14x18x1/8	Price.....	3.15
63R5692— 7x 9x3/16	Price.....	1.20
63R5694—14x18x3/16	Price.....	4.65
63R5696— 7x 9x¼	Price.....	1.58
53R5698—14x18x¼	Price.....	5.95

High Frequency Ammeter Jewel Pattern No. 25

An exceptionally accurate instrument. High frequency current heats a thermo-couple and the resultant energy is measured by a sensitive D'Arsonval galvanometer. Well damped, insuring a steady pointer. Temperature variations have practically no effect on the readings. Side terminals avoid making inductive loop in connection. Base diameter, 4¾ in. Ship. wt., 6 lbs.

63R5360—0 to 3 ampere Range. Price....$14.25
63R5361—0 to 10 ampere Range. Price.....14.25

Hot Wire Ammeter

63R5365—Will measure accurately the radiation in the aerial and ground circuit. A necessity for tuning the transmitter to 200 meter wave. Range 5 amperes. Will stand 100 per cent overload. Base is of hard rubber composition. Nickel-plated rim, size 3½ inches diameter. Ship. wt., 1 lb. Price..... $4.25

Variometer

63R5640—This is the same high grade variometer that is used in our Regenerative set. With two variometers, a loose coupler and the proper binding posts, dials, knobs, etc., a regenerative set may be constructed at a very low cost. Can also be used separately for grid and plate tuning. Designed for very low dielectric losses and maximum range of inductance. Rotating element contacts made through ¼ in. shaft so that ball may be continuously rotated without breaking connection. Ship. wt., 2¼ pounds. Price.....$4.45

Loose Coupler

63R5642—The same high grade loose coupler used in our Regenerative set. With a loose coupler, two variometers and the proper binding posts, dials, knobs, etc., a regenerative set may be constructed at a very low cost. Can also be used separately. Primary has seven taps which can be connected up to vary inductance. Secondary rotates. Connections are made through shaft. Ship. wt., 3½ pounds. Price $4.20

Electrose Insulators

Electrose insulators are the standard in the wireless field. They stand up under all conditions met with. Eyes are wrought iron galvanized. Ship. wt., ½ to 2½ lbs.

Article No.	Dia. In.	Lgth. Ov. all In.	Strgth Lbs.	Elec. Value Dry Volt	Value Rain	Price
63R5630	2⅛	3¼	250	40,000	25,000	28c
63R5631	1½	4	1,000	40,000	15,000	42c
63R5632	1½	10½	1,000	90,000	50,000	66c

Electrose Wall Insulators

63R5634—Special Wall insulator for lead in wires. Has hole through body for wire. Body diam., 2 in. Length over all, 5-9/16 in. Ship. wt., 1 lb. Price.....93c

Switch Levers

Smooth in operation, always perfect compact without binding Black composition knobs, diam. 1¼ in. Metal parts of brass nickel-plated. Ship. wt., 4 oz.

63R5651—Complete knob, laminated lever and screw permitting mounting on panels not over ½ inch thick. Each.. 39c

63R5653—Complete knob, spring lever, shaft, two lock nuts and bushing for panels up to ⅝ inch thick. Each.. 49c

Send cash with your order to cover the price of the merchandise you select and transportation charges. Send currency by registered letter only. You take no risk in dealing with Montgomery Ward & Co., as we are one of the largest and most reliable institutions in the world.

Magnet Wire

For repairing motors, other electrical apparatus, experimental work, etc. One piece only on a spool. Wire is standard B and S gauge. Insulation and wire both perfect and uniform. Supplied only in weight spools given.

Double Cotton Covered Magnet Wire Art. No. 63R1350		Belden Enameled Magnet Wire Art. No. 63R1400	
Price 8 oz. Spool	Price 1 lb. Spool	Gauge	Price 8 oz. Spool	Price 1 lb. Spool
$ .65	$ .95	14	$ .45	$ .85
.69	1.03	16	.46	.87
.74	1.12	18	.48	.92
.84	1.34	20	.62	.94
.92	1.54	22	.65	.98
1.02	1.74	24	.70	1.10
1.18	2.06	26	.76	1.20
1.46	2.62	28	.85	1.38
1.64	2.98	30	.88	1.42
1.95	3.58	32	.92	1.52
2.84	5.34	36	1.20	1.98

New Code, Rubber Covered Wire, Single Braid

Solid conductor copper wire, insulated with rubber compound over which is one cotton saturated braid. Ship. wt., 3 and 13 lbs. per 100 ft. Sold only in lengths listed.

63R3015—Size 14. Price for 25 ft.....$0.32
Price for 100 ft...$1.17 Price for 500 ft.....$4.95
63R3032—Size 6. Price for 10 ft..... .54
Per 25 ft.....$1.23 Per 100 ft.....$4.50

New Code Twisted Pair Cotton Lamp Cord

Two conductor, twisted New Code Lamp Cord. Conductor consist of fine copper wire strands twisted together. Covering is of fine quality interwoven yellow and green cotton. Ship. wt., 6 lbs. per 100 ft. Sold only in lengths listed.

63R3175—Size 18. Price for 10 ft.....28c
Per 25 ft.....65c Per 100 ft.....$2.37

Porcelain Tubes

Unglazed Porcelain Tubes, 5/16 in. inside; 9/16 in. outside. Length given is from underhead to end. Ship. wt., per dozen, 1 to 2 lbs.

63R3902—Length 3 in. Per dozen.....$0.22
63R3906—Length 6 in. per dozen..... .43
63R3908—Length 8 in. Per dozen..... .70

Unglazed Porcelain Cleats

Take No. 10 or smaller wires. Have 2½ in. wire centers. Ship. wt. per dozen pair, 3 lbs.

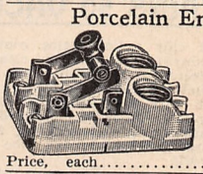
63R3923—2 wire cleats. Price per dozen 42c

Solid Porcelain Knobs

New Code No. 5½ solid porcelain knob. Height, 1-9/16 in. Diam., 1⅛ in. Hole, ¼ in. Groove, 5/16 in. Ship. wt., per doz., 1½ lbs.

63R3927—Per doz. 32c
No. 4 solid porcelain Knob. Height, 1-11/16 in. Diam., 1½ in. Hole, ⅜ in. Groove, ⅜ in. Ship. wt., per doz., 2 lbs.
63R3929—Per doz.....45c

Porcelain Entrance Switch



National Electric Code Standard Porcelain Base Entrance Switch or main line cut-out switch. Takes plug fuses. Capacity, 125 volt, 30-amperes.

63R4305—Two-pole switch. Ship. wt., 1½ lbs. Base size, 3¼x5¼ in.
Price, each.....76c

Antenna and Copper Wire

Supplied only in size coils listed.

63R5150—Aerial cable. Composed of seven strands No. 22 B. & S. gauge hard drawn tinned copper wire. Ship. wt., 6 lbs. per 100 feet.
50 feet, 49c 100 feet, 85c 500 feet, $3.95
63R5151—Bare copper wire No. 14 gauge.
50 feet, 22c 100 feet, 42c 500 feet, $1.70
63R5152—Bare copper wire No. 12 gauge.
50 feet, 33c 100 feet, 62c 500 feet, $2.65

A high grade Hardened Steel Plier. Used a great deal on all electrical work. Handy around any work shop. Ship. weight, 6 oz.

63R5802—6-inch Sharp Nose Plier. Price each.....$1.23

Best Hardened Tool Steel Diagonal Jaw Side-cutting Nipper. Length, 5 in. Ship. wt., 4 oz.

63R5806—Diagonal Jaw Pliers. Price. $1.28

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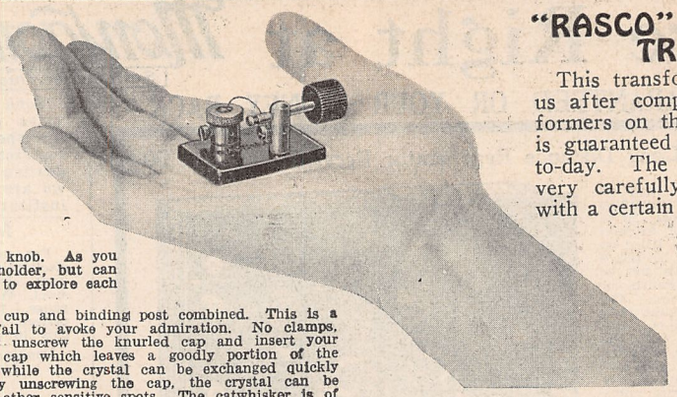
THE RASCO "BABY"



The smallest and most efficient detector in the world—as well as the cheapest. Our illustration is an actual photograph, and while the various details can be seen at a glance, we feel so enthusiastic about it that we must tell you all of its good points. First, there is a solid hard rubber composition base, size 1½" x 1⅛". We have not forgotten two holes to screw down the detector.

Then we have the nickel holder and binding post combined which holds the sliding, knurled, hard rubber composition knob. As you see, this knob not only revolves in its holder, but can also be moved back and forward in order to explore each point of the detector crystal.

Next we see the patent nickel detector cup and binding post combined. This is a little marvel all by itself and will not fail to avoke your admiration. No clamps, no soft metal to fuss with. You simply unscrew the knurled cap and insert your crystal into the stand, screw home the cap which leaves a goodly portion of the crystal exposed. The contact is perfect, while the crystal can be exchanged quickly in less than three seconds. By slightly unscrewing the cap, the crystal can be changed in position, in order to explore other sensitive spots. The catwhisker is of phosphor bronze and is attached to the horizontal bar by means of a filister head screw. Can be readily exchanged in less than two seconds. Wires can be connected to the binding post in a jiffy. All metal parts are nickel plated, and you will be proud of this little masterpiece.

No. 1898 Rasco Baby Detector complete with galena crystal, prepaid..... **50c**

No. 1899. The same but furnished with an additional piece of tested radiocite crystal, prepaid **75c**

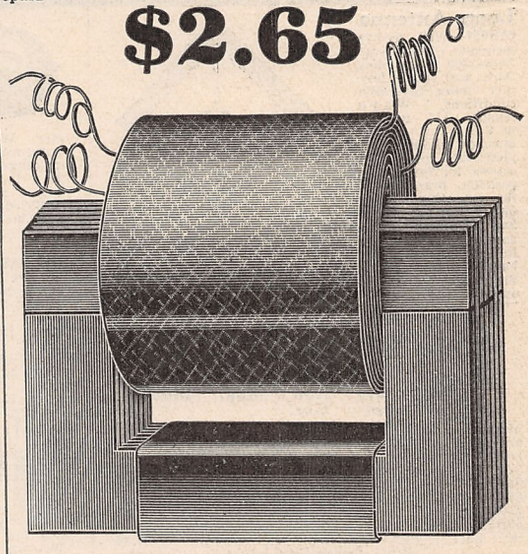
"RASCO" AUDIO FREQUENCY TRANSFORMER

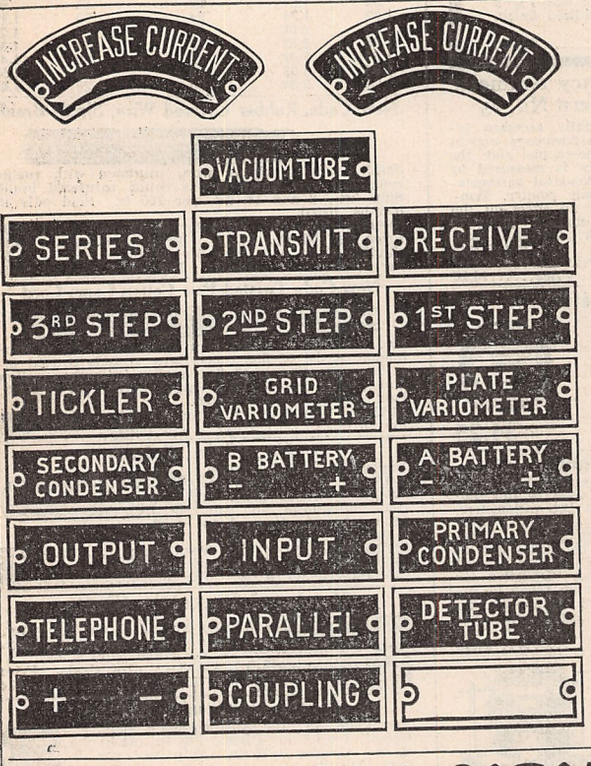
This transformer has been developed by us after comparing all the various transformers on the market. This transformer is guaranteed to equal any on the market to-day. The primary and secondary are very carefully built and are impregnated with a certain wax in vacuum. The stampings are of the best silicon steel. Only the very best material is used throughout.

Realizing the fact that most amateurs desire to "make their own" we *furnish this transformer unassembled.* Directions which accompany the transformer are such that anyone can put the parts together in about ten to twelve minutes. This saves you considerable money, for the reason that manufacturers who assemble the transformers must charge you for the assembling work.

Illustration as shown is in full size. The weight complete is ten and one-half ounces. *Note also that we ship all goods prepaid.* **We pay the freight.**

No. 1100 "Rasco" Audio Frequency Transformer **NOT ASSEMBLED**, prepaid **$2.65**





"RASCO" NAME PLATES

Our name plates are of brass with a black background. The name is nickel-plated, standing out well upon the black background. Illustrations are in full size. Each plate has two screw holes. Order by name.

The two top plates, "Increase current," list at 10c each, illustrations full size. All others are 5c each. We also have these, not illustrated: Phones, Loading Coil Aerial, Ground, Secondary, Primary, Audion, Detector, Off, On, each 5c. In dozen lots, 50c prepaid.

NEW. The white plate in the lower right-hand corner is blank, and made of such material that you can write your own lettering on it with pencil, ink, or China ink. Price each 5c.

WE *GUARANTEE* EVERY ORDER SHIPPED WITHIN 24 HOURS

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THE "RASCO" CATALOG A COLOSSAL EVENT

There are many radio catalogs, but the "Rasco" catalog marks a radical change for the simple reason that it

CONTAINS 50 VACUUM TUBE HOOK-UPS

This is the one and only radio catalog containing such wonderful free information. Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector; detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; C.W. transmitters; self-rectifying 2 tube C.W. transmitter; V.T. transmitter with 6 volt battery; radio-phone using plate and grid modulation; one tube radio transmitter and receiver; experimental radiophone; radiophone using Colpit oscillator circuit.

This list is only a partial one. You must positively see this wonderful book to appreciate it.

It is made to fit the pocket—has heavy covers to withstand the wear and tear which it is sure to have at your hands because it will be your constant companion.

And Oh yes! Before we forget it. If you are in need of the following remember "Rasco has it." These are only a few things contained in this catalog. **Lugs, Nuts, Dials, Knobs, Bakelite Sheets, Washers, Crystals, Litz Wire, Selenium, Cord Tips, Cap Nuts, Tin Foils, Name Plates, Spring Posts, Switch Parts, Metal Ribbon, Carbon Balls, Binding Posts, Switch Points, Switch Levers, Carbon Grains, Metal Pointers, Contact Points, Low Melting Metal, Carbon Diaphragms, Screws, Copper Strip, "Spaghetti" Name Plates, Sliders, Mica Switches, Resistance Wire, Variocoupler Rotors, Test Clips, Condenser Plates, Condensers, Antenna Connectors, Threaded Brass Rod, Ground Clamps, Etc., Etc.**

The catalog contains 200 illustrations. On account of its great cost, this catalog cannot be distributed free of charge. It will only be mailed upon receipt of **15c *in stamps or coin.***

Radio Specialty Co

Remember that this business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be side-tracked by us. A trial order will make you a life customer. You can order from the above illustrations. "We can only stick you once." Try us with a 50c order.

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RADIO NEWS

H. GERNSBACK—Editor
ROBERT E. LACAULT—Associate Editor

Vol. 3 NOVEMBER, 1921 No. 5

THE RADIO EXPERIMENTER

WE have often in these columns urged the Radio experimenter to get off the "beaten track," and do something original. Of course, a good many of our amateurs are not asleep by any means, and are doing wonderful work, but they are very much in the minority these days, and for every amateur who gets off the "beaten track," there are at least a thousand who are satisfied to plod along in the good old way.

Take for instance such a simple subject as amplification; for at least two years we have gone wild about audio frequency amplification. We pick up this journal, or any other for that matter, and on every page we are stared in the face by some outfit, or some stunt, or some hook-up containing audio frequency amplification. Every time the editor sees an article or just a mention of audio frequency amplification, he goes pretty wild these days, but still they come on, and what is worse, the manufacturers themselves aggravate the situation by developing only new styles of audio frequency amplifiers

Far be it from us to say that audio frequency amplification is not a good thing, but there certainly is something far better than low frequency amplification. We, of course, refer to Radio frequency amplification, the thing that practically remains unknown to the amateur in this country, and that the average amateur approaches with terror in his heart.

Just now it seems to be the original sealed book, with seven great big seals on it, as far as the amateur is concerned. Strange to say, in Europe where Radio is so much restricted, and where even buzzer-sending outfits are taboo, and where you must swear your soul and everything else away to the Post Office Department before you can get a license to operate a galena detector—in these countries they seem to be further advanced on the subject and are now using radio frequency amplification.

This is particularly true of England, who is leading in this way. Radio frequency amplification is superior to the audio frequency for the reason that any amount of current received in the antenna is amplified and may be then rectified by the detector, while if the current received is very weak, it cannot be rectified by the detector which has such a characteristic curve that no rectified current is noticeable in the plate circuit and cannot be, therefore, amplified even with several stages of amplification. Let us say here that all of the detector tubes on the market are only efficient for rectification of currents of a certain strength and best results are obtained if the oscillations to be rectified are amplified before.

To make a homely analogy, it is as if you were trying to pump out with a powerful pump, the water from a tank, by means of a small faucet. The powerful pump would be useless as there would be almost nothing to pump, while if the water supply was coming under heavy pressure, the pump emptying the tank would work at its full capacity.

Besides many advantages, radio frequency amplification requires only some air core transformers, which may easily be made, and makes possible radio control, operation of relays and recorders, transmission of pictures, etc.

And also, why does not the amateur who has a little machine shop get off the "beaten track," and do some experimenting in the transmission of pictures? Once in a great while, we print an article from some enterprising amateur who has had the spunk to build such an apparatus. Just the same, we predict that when five, or ten years at the most, are up, every amateur will have his radio picture machine.

Recently the signatures of General Foch, and General Pershing were sent across the Atlantic by radio on the Belin apparatus. There is no good reason why the amateur cannot do the same thing for smaller distances at any time.

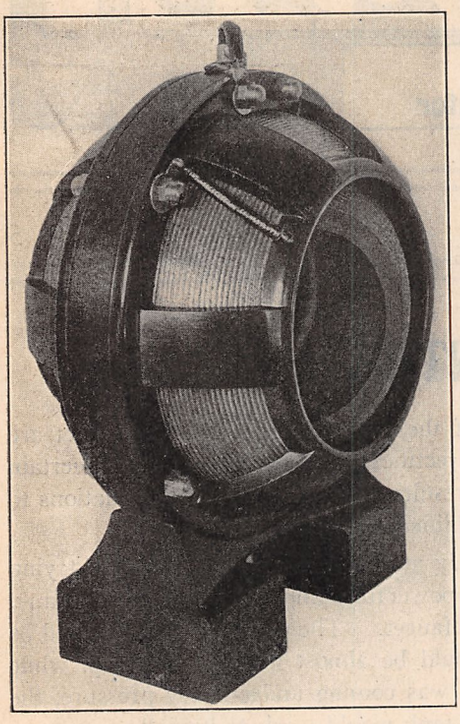
In the very near future, the amateur in New York will buy the first copy of a New York evening paper, wrap it around his cylinder, and send out a whole sheet by radio. A thousand miles away another amateur will have a receiving machine that will reproduce the printed page, type, pictures and all, in less than a half hour. This is a thing impossible to do by ordinary wireless telegraphy, if every word has to be transmitted. The radio picture transmission solves all this. Thus, in time, a great piece of news "breaking" in the city, will be sent broadcast by the enterprising amateur, who will send the entire front page of the newspaper, for instance, and the radio facsimile can then be exhibited in a distant town from 18 to 24 hours in advance of the receipt of the actual newspaper.

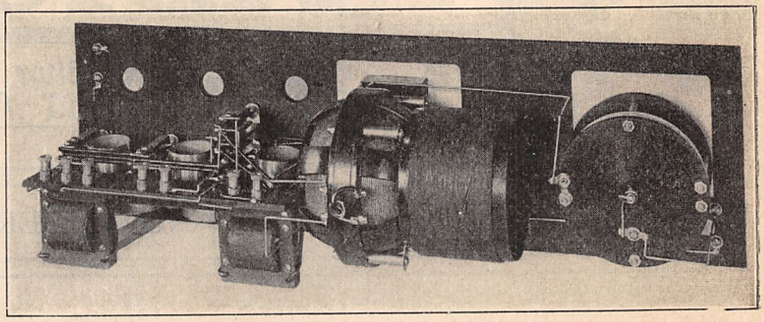
All this is not a mere dream, but it already has been accomplished today. It is up to the amateur to make the thing popular.

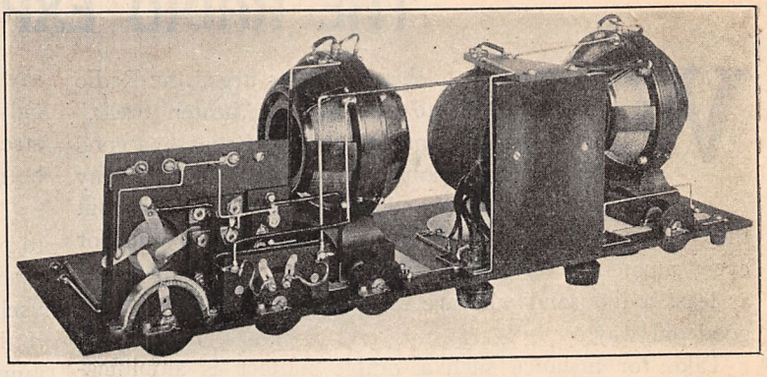
H. GERNSBACK.

High Class Workmanship in Amateur Radio Apparatus

By ARTHUR H. LYNCH





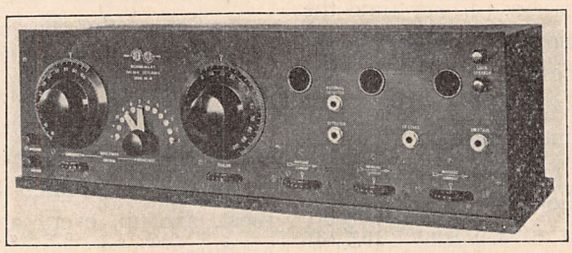


On the right the photographs showing the interior of amateur receiving sets give an idea of the degree of perfection attained in the manufacture of such apparatus by American firms. Compare the workmanship and compactness of these instruments with those of earlier days. On the left is a close-up of a variometer mounted on a moulded composition frame.

THERE was a day, not so very long ago, when America had to bend her knee in homage to the efficiency of the foreign worker. Germany, France and England were unquestionably our peers, in the manufacture of all kinds of instruments which were mechanically and scientifically correct.

Today there is a different story to tell. The accompanying illustrations bear witness to the fact that, i workmanship, design and ease of operation and control, not to mention the appearance, it is now time for foreign manufacturers of radio apparatus to take off their hats to America.

The story of bakelite is a very interesting one, for it has changed the whole color of the insulating industry. Most of us remember when it was introduced and vied with vulcanite for supremacy as material for front panel and turned dials and knobs. Today, it is found moulded in all forms, made to suit the specific requirements of the unit in which it is used. It is now cheaper, can be turned out more rapidly and the finished product is more pleasing to the eye and more accurate in its dimensions than could previously be made by the hand of the most skilled worker.



This Small Compact Amateur Set Embodies a Tuner and a Two-Stage Amplifier Fitted With the Very Latest Improvements; it Tunes up to 3,000 Meters.

Typical of the external appearance of this grade of amateur radio apparatus is the cabinet set which is here shown. It will be noticed that it is complete in every detail. The wave-length range is from 150 to 3,000 meters, and it is controlled by three knobs. Telephone jacks permit the use of an external detector, if it is desired, the detector tube of the set itself, or one or two stages of amplification. Posts are provided for the connection of a "Loud Speaker," while all the connections for the batteries for the tubes are made to binding posts, through apertures in the rear of the cabinet.

The view of the interior reveals the character of workmanship, which is now putting American amateur radio apparatus in a class by itself. An interior of another receiver is also shown, in order to give a more detailed explanation of some of the new and very improved features incorporated in modern apparatus. Particularly striking is the new form of variometer, which is of moulded bakelite and is made in such a way as to obviate the necessity of having the bakelite come between the turns of the stator and

(*Continued on page* 410)

Opera Singer Heard 300 Miles Away

CONCERTS by Radio are now common things, and in all the exhibitions of a more or less technical nature, a Radiophone station is used to "tell the world" of the doings at this particular show.

At the Electrical Show, held in the 71st Regiment Armory in New York City recently, such a station was installed and broadcasted daily some information and news.

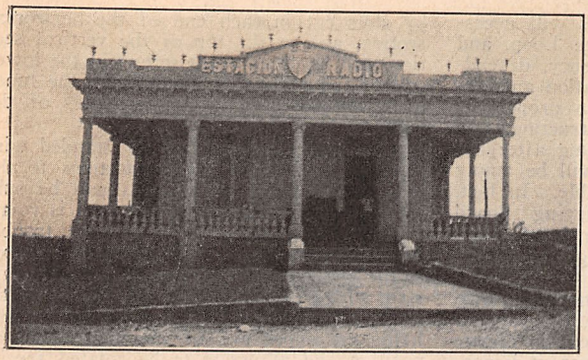
In the evening, a concert was given by Radio to an audience spread over a wide area, and well-known artists, singers or musicians of the opera company, could be heard quite distinctly, thanks to a perfect modulation.

If in each home a receiver with loud speaker were installed, it would replace the phonograph, for with a Radio set it is possible to hear the artist himself instead of his stored voice.

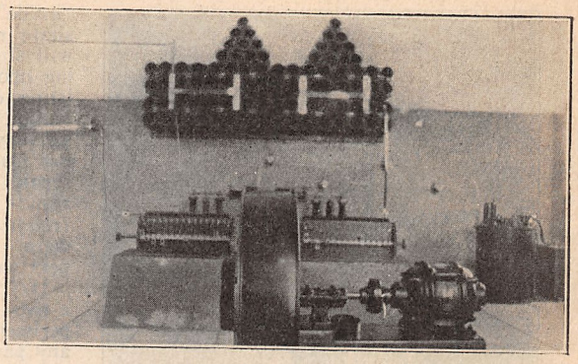
In this view showing Miss Anna Case singing in front of the microphone, may be seen the radiophone station installed at the electrical show in New York City, thanks to which thousands of amateurs could hear the concert in their homes.

Cuban Radio Station

By U. MUÑIZ*



Note in This View of a Cuban Radio Station the Counterpoise Insulators Fixed on the Roof.



On the Wall Are Fixed the Leyden Jars Forming the H.T. Condenser. On the Floor Behind the Blower May be Seen the Quenched Gap.

THERE is no other labor more full of flavor than reporting news by Radio, and there is no other thing that should appeal more to the young folks making their first "tests."

On the morning of the first of May, I awoke very early and started for the Luz wharf, where I boarded a boat, bound for Casa Blanca.

The Casa Blanca's side came nearer and nearer, and at last I was climbing up the old stairs of the hill on my way to Triscornia, whose huge towers we see from Havana. It seems an easy task to arrive safely, but in reality it is a very hard one, and when, tired out, I passed the Chinese-like porch of the station's property fence, a profound sigh of satisfaction escaped from my lips.

The amiable reception extended to me by the mechanic in charge of the station compensated for the trouble the trip cost. My party was invited to make use of a fine receiving set installed there for the practice and pastime of the guardians. My companion took advantage of this invitation while I went on a tour of inspection.

A great, three-blade switch makes or breaks, as desired, the circuit bringing the prime mover, electric current, at a pressure of 220 volts, 60 cycles, from Casa Blanca's power plant. Wires under the floor feed this current to the 35-h.p. motor driving the huge 380-volt, 435-cycle alternator, which is fed by a little 4-k.w. D.C. generator coupled to the shaft; this motor group is mounted on a granite base specially designed, and is of the Crocker-Wheeler make.

Iron conduits protect the wires running from the motor generator unit to the Marconi 20-k.w. panel board. Ammeters, voltmeters, wattmeters, frequency meters, rheostats and switches are nicely distributed in this large, four-meter high board of special insulating compound. At the average power, the ammeter registers 13 to 15 amperes in the antenna, the voltmeter 23,000 to 25,000 volts, and watt input to the transformer, 15 to 16.5. The frequency ranges are from 435 to 475, no more.

Continuing the wiring: A large, open core, 25,000-volt secondary, step up transformer, delivering its high potential to a battery of 84 leyden jars, and a pair of quenched gaps, connected in series with two special design semi-stationary sparkers. This special type of spark gap has a rocking arm carrying the contacts, and operates through magnetic action, the spark occurring at the middle of a complete rock of the shaft.

To the huge primaries, three meters in diameter, are wound 20 turns 1½" wide copper strip; this high frequency oscillating current is brought by means of gross copper tubing conduits. The primaries are two coils of the same size, connected in series

(*Continued on page* 428)

Cuban correspondent for RADIO NEWS.

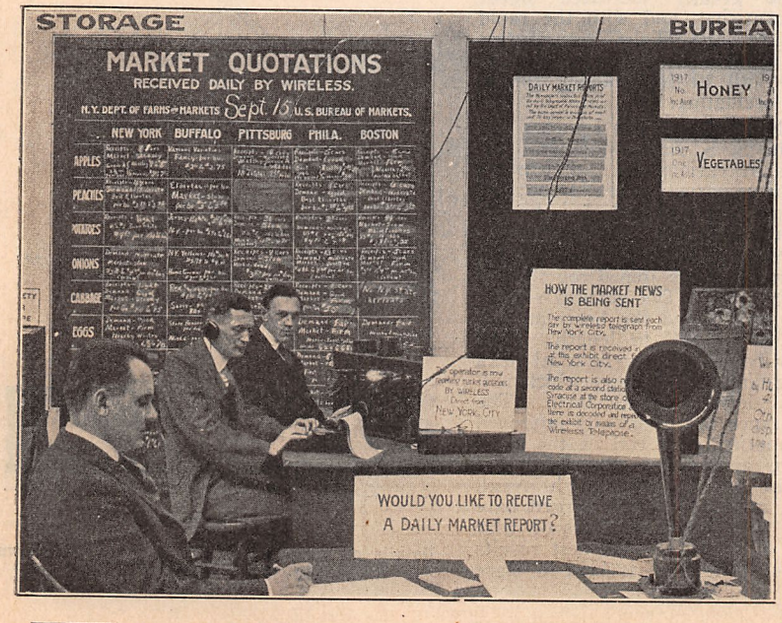
Farmers are Shown How to Receive Radio Market Reports

By H. D. PHILLIPS*

AT the State fair held in Syracuse, N. Y., September 12 to 17, the New York State Department of Farms and Markets gave a public demonstration of the reception of market reports by Radio.

The object of the demonstration was two-fold: first, to try out for our own information the wireless method of transmitting our market reports; and, second, to arouse interest on the part of farmers and shippers in the possibility of developing such a service by wireless in New York State.

A receiving set was installed in the exhibit of the Department at the State Fair grounds. This was provided with a Magnavox which amplified the sound of the wireless sending so that it could be heard by the crowds in front of the exhibit. By means of this receiving set the market reports were received at the exhibit directly from New York City, where they were transmitted by a commercial wireless agency. This company also appointed an operator to handle the receiving set at the fair grounds.



This Receiving set installed in a booth at the Syracuse State Fair, showed to the farmers who attended, how easy it was to receive the market and weather reports sent by radio.

Two different market reports were received each day. The first came through about 9:30 a. m. and gave information as to receipts and prices on the early morning New York City market for various commodities including lettuce, celery, beans and certain others not covered in the report received later in the day. As soon as received at the exhibit, this early report was de-coded, and mimeographed copies of the same were prepared as promptly as possible for distribution to the crowds at the Fair. Copies were also delivered each day to the various County Farm Bureau exhibits located in other buildings on the grounds.

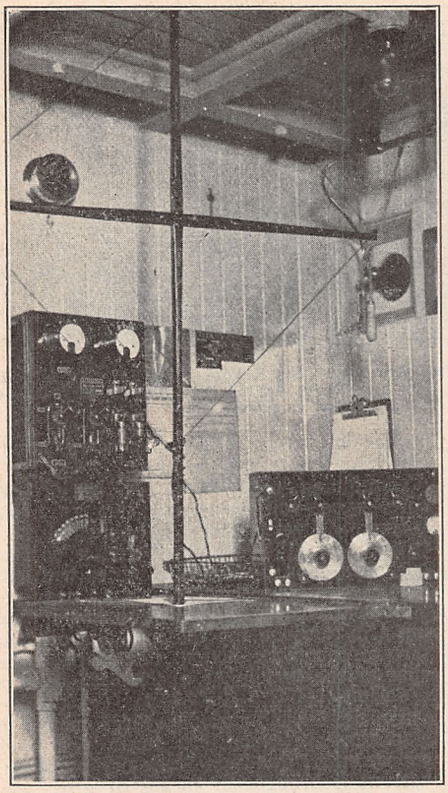
The second market report was received in the same manner a little after noon each day. This report covered not only receipts, market conditions and prices in the New York market for apples, peaches, grapes, potatoes, cabbage, onions, eggs, butter and cheese, but also carried similar information in regard to these commodities in the Pittsburgh, Philadelphia and Boston markets. The information concerning these latter markets was made possible through the coöperation of the U. S. Bureau of Markets, which, by means of its leased wires, gathered the information and supplied the same to the New York City office of the Department of Farms and Markets. This information, when received by the New York office of the Department, was added to its own report covering the New York City market and the consolidated report was then put into code and delivered to the sending agency. When received at the exhibit at Syracuse, this report was de-coded and posted on a large blackboard so ruled

(*Continued on page* 428)

*Director Bureau of Markets and Storage.

The Radio Compass At Sea

By H. W. UNDERWOOD



A Simple Type of Radio Compass Built by an Operator and Installed in the Radio Room of a Ship.

THE radio compass, or direction finder, although in general use at shore stations in all of the principal countries of the world, is seldom found on board "Merchant Ships." Of course, the erection of the many efficient compass stations ashore has a tendency to discourage the installation of direction finding apparatus on shipboard. Also the obstacles to be overcome are more numerous at sea than on shore, therefore we cannot look forward to any extensive or rapid adoption of the radio compass on merchant ships in the near future.

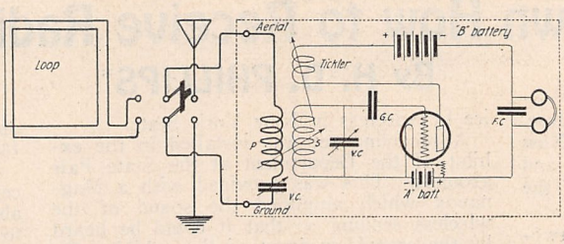
In fact, the few installations. we may find here and there will be the result of the initiative of individual operators, and their desire for experiments, therefore, it is with a desire to encourage both the marine operator and the amateur to more and more experimental work along this line, that the following article is written.

Probably the chief difficulty confronting the Marine operator is the location of the compass coil, and the extension of the revolving shaft and pointer into the radio room, in such a manner as to facilitate rapid and accurate operation, and at the same time leave the deck overhead free from leaks, and neat in appearance. Of course, if you have a *good* carpenter aboard, and can secure his services, this difficulty would soon be overcome, but you will find that on most ships, the "OM" and "Mate" will want positive proof of the merits of "Spark's" new-fangled ideas, before giving their permission to mutilate a perfectly good deck.

Also on many of our latest and largest ships, the deck over the radio room is utilized for water tanks, battery boxes and other odds and ends too numerous to mention. However, we can usually overcome these obstacles in a simple and fairly efficient manner by installing the compass coil "inside" the radio room. This will necessitate reducing the size of the Loop, and will slightly decrease its efficiency, depending upon the particular installation and existing conditions, but with the proper attention to details, while constructing, and by very careful and sharp tuning after being placed in operation, you will be amply repaid for your time and trouble. In fact, results obtained on the Shipping Board freighter S. S. *Jalapa*, with an inside loop, were very satisfactory, although no amplifiers were used.

If you happen to be lucky enough to own a two- or three-stage amplifier, you can experiment to your heart's content in almost any part of the world. However, it is possible to secure good results with only one detector bulb, if the proper circuit and careful tuning are employed. While using a single detector without amplifiers, and one of the Navy Type "S. E. 1420" tuners, distances of 90 miles, in the daytime, were covered with French, English and German shore stations, and the bearings taken were accurate within three degrees. Considering that our loop had not been previously calibrated for errors, and that numerous metal objects were located nearby, such as iron water tanks and ventilators, these were quite satisfactory results.

Bearings were taken on other ships, as far away as 60 miles, in the daytime. Of course extremely close tuning and a very good detector bulb are absolutely essential for the above results. Also a regenerative circuit with a good oscillating tube must be used, being very careful to keep the bulb oscillating at all times. Many operators object to copying spark signals with the audion oscillating, on account of the change from a clear, high note to a rough, hissing tone, but the greatly increased signal strength is surprising, and with the rapid increase of "Arc" and "Tube" transmitters on practically all wave-lengths the *alert* operator will do all of his standby tuning with the bulb oscillating.



By Means of a Change Over Switch, the Receiver of the Stations May be Used Either With the Loop or the Aerial.

A general description of the compass coil installed on the S. S. *Jalapa* follows. Direction finders of various sizes, dimensions and methods of construction are in use; but the "Loop" type herein described, is by far the simplest and easiest of construction.

The loop frame consists of two lengths of 1" x 1" spruce neatly joined together in the form of a cross. The vertical section being 4½' in length, and the horizontal or cross section being 3⅓' in length. Both sections should be shaped in cylindrical form except at the joint of the cross, which will look neater if left in square form. The general appearance can be greatly improved by slightly tapering each end of the horizontal section, and giving the completed frame a coat or two of good varnish. Next, procure about 25' of No. 18 or larger, bare copper wire. Two complete turns of wire ½ inch apart are used for the best results on 600 meters. The wire is held in place by slots cut in each end of the horizontal section, and at the top of the vertical section, and by small brass screws at the lower end of the vertical section, where the tuner leads are soldered to the terminals of the loop.

A good grade of insulated stranded wire should be used for the connections to the loop terminals, as these leads will be subject to severe twisting as the loop is rotating, but if good wire is used no trouble will be experienced. The loop is secured to the upper deck by means of a brass angle strip with a hole drilled in its center slightly larger than the small brass screw, which holds the upper end of the loop frame in position and allows it to be rotated freely. Drive a small nail in the center of the lower end of the frame and then remove the head of the nail. Next drill a small hole, in your table top, sufficiently large and deep enough to accommodate an old unused phone cord tip, which should be driven into this hole until almost flush with the table top. Set the lower end of the loop frame in this; it will make a very satisfactory bearing for the loop frame, and will allow it to rotate freely without undue friction and wear.

We must now have a pointer, and circular dial, with all 360 degrees marked off. This dial can be either made by the operator, or purchased from some nautical supply house. The lower bearing of the loop frame must, of course, extend exactly through the center of your dial. The pointer can be made out of stiff copper wire, and should be firmly attached to the lower end of the loop frame about ¼" above the dial by means of a small brass screw. The pointer must point exactly in the same plane as the loop wires, and should be adjusted in this position before setting up on the screw. Then rotate your loop until the pointer bears exactly forward, or in line with the ship's head. Now adjust your circular dial until 0 or 360 degrees is exactly under the pointer, then secure the dial in this position permanently. A small portable compass from one of the lifeboats could be used to advantage in determining the correct ship's heading and the corresponding pointer adjustment.

To operate the compass loop, tune

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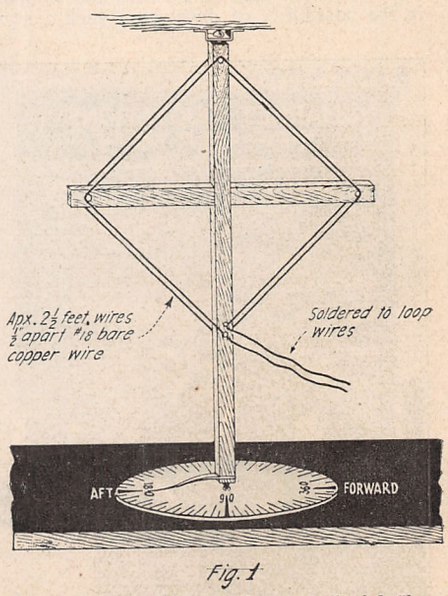
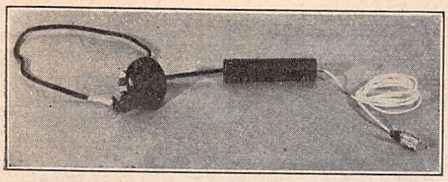


Fig. 1

Details of Mounting of the Loop Aerial Shown in the Photograph.

The Audio Frequency Radiophone

By EARL G. HANSON



This is the Complete Receiving Set Used to Receive Audio Frequency Radio Telephony. The Body of the Operator is Used as Counterpoise, While a Brass Bed or Other Large Metallic Surface is Used as an Aerial.

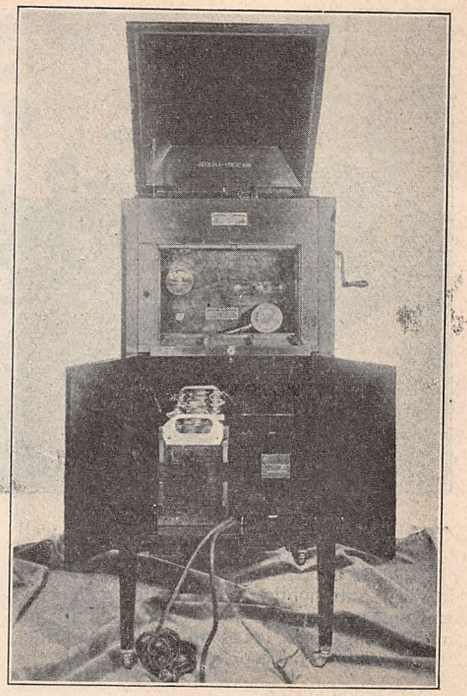
THE RADIO NEWS for August, 1921, described some experiments by William Wallace MacFarlane, of Elkins Park, Pa., on radio at the New York Stock Exchange. The article stated that Mr. MacFarlane has experimented with small receiving outfits adapted to be carried by brokers on the curb and in the stock exchange of New York. The development of this apparatus in general is very fascinating and the results to be obtained with apparatus of this general description are quite surprising.

Readers will perhaps recall in the November, 1919 issue of *Radio Amateur News* and in the *Popular Science Monthly* for September, 1919, an article on the audio frequency wireless telephone which describes an electrostatic receiver used by the wounded soldier patients at Walter Reed Hospital in picking up wireless music in the various wards of the hospital. The electrostatic receiver described in that article and also the transmitting phonographs, is reproduced in the accompanying photographs.

It appears that Mr. MacFarlane has hit upon this same principle and is utilizing substantially this same receiver in his work. It is interesting in considering the Walter Reed Hospital equipment how successfu[l] the music is transmitted electrostatically from a central transmitting phonograph located in the library of the hospital. This phonograph is electrically connected through a group of transmitters on the tone arm of the machine with an audio frequency transmitting circuit connecting through an iron core transformed with an antenna and ground system. In the many wards of the hospital the soldier patients are provided with a small electrostatic receiver as illustrated in the photographs which accompany this article. The soldier patient makes connection with the clip of the receiver to the bed spring and grasps the small cylinder by hand and holding the receiver to the ca[r] intercepts the music being transmitted wi[re]lessly at audio frequency throughout the hospital.

I am glad to note that Mr. MacFarlane is carrying on the experimentation with this form of wireless receiver which is not as yet developed to its full extent, and I feel sure that audio frequency Radiotelephony will bring some interesting results as to the range obtainable.

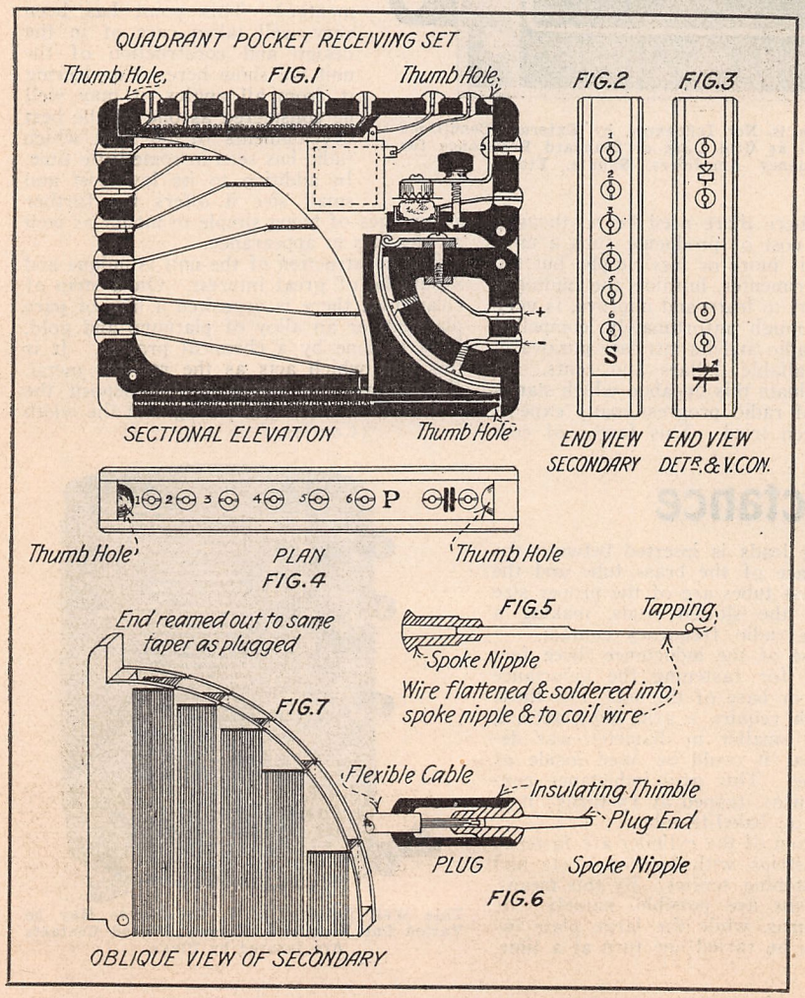
The amateurs who often look for something new and simple in the line of Radiotelephones, might obtain good results with a set of a certain power.



In This Phonograph is Installed an Audio-Frequency Radiophone Transmitter, Which Sends Music Within a Small Radius Without the Use of a Source of H.F. Current.

"Quadrant" Pocket Radio Set

By SEAN BRICRIU



Here is a cleverly designed pocket receiving set entirely self-contained, with all the parts enclosed. Note the variable condenser and the secondary, which may be pulled out to vary the coupling.

THESE are drawings of a small pocket wireless set, which was designed by the writer, after reading the editorial in the February RADIO NEWS, in the hope that it may meet with the approval of those wireless amateurs who go in for small, efficient sets.

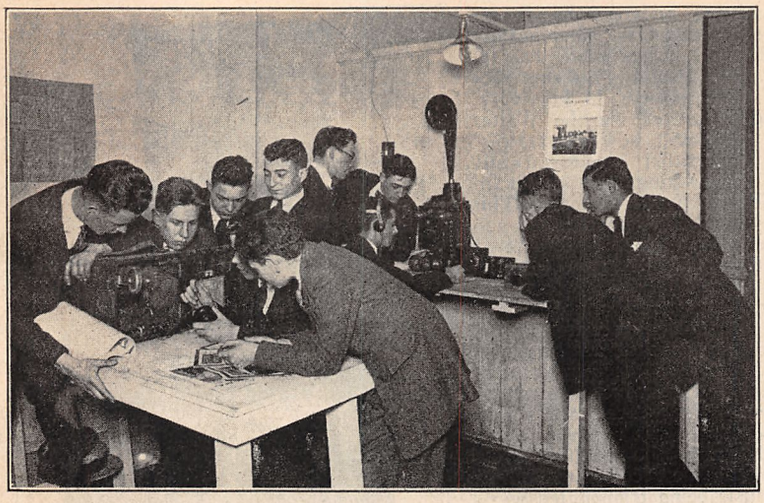
This design is compact and self-contained and has a loose coupler action, or can be used as a variometer. In the sectional drawing shown in Fig. 1, there are three quadrants contained within a flat box. The large quadrant on the left-hand side is the secondary, and the oblique view of same, Fig. 7, shows the method of winding, while the sectional view shows the method of tapping this quadrant. It will be noted that there are no projecting binding posts. The method suggested by the writer is the use of cycle-spoke nipples, which are inserted into the hard rubber to act as sockets, into which plugs can be fitted. This is shown clearly in Fig. 5. It will be seen that a stout copper wire is soldered into the small end of nipple and this wire is flattened out at other end to take the coil wire to which it is soldered. Fig. 6 shows how the plug is constructed, using nipples, and the vulcanite insulating thimble will prevent body capacity effects when handling the plugs.

The large quadrant is first made and two flat plates are fastened to this and carefully cut until the quarter-circle is accurate. Slots are then cut on the edges, as shown in Fig. 7, using a very fine toothed hack-saw for this purpose. The holes for the sockets or nipples are next boxed in the face of quadrant; these holes should be slightly smaller than the nipples. The tapping wires are next soldered into the nipples and the hole in the nipple is reamed out to the same taper as the plug. (A steel knitting needle filed to a D section makes an excellent reamer.) The nipples are

(*Continued on page* 426)

An Ideal Radio Service

By H. L. ARTHUR



This is not a radio club, but the "meeting room" of a New York radio store, where the amateurs may exchange ideas and try the apparatus they wish to buy.

TODAY'S profitable business may well be considered to rest upon the corner-stone of satisfactory service. Whether it be automobiles, typewriters, electric washing machines or even so humble a commodity as a cake of soap, if its manufacturer expects to keep it on the market, the most essential asset the article must boa t is service—it must make good. Every assistance which the distributor offers to the consumer may be considered as business insurance and the value of the policy may generally be judged by the amount of premium, which, in this case, is nothing more nor less than the effort to help the consumer get the best results from his purchase.

In the downtown district of New York City there is a new, albeit progressive dealer in radio supplies and other electrical sundries. This concern has undertaken a most comprehensive selling plan, which, though it is not entirely new, is being carried out with such precision and satisfactory results as to make it the object of much comment.

In the rear of the store, which is quite similar to most stores where electrical commodities may be purchased, a partition has been put up, forming a small room, which has been furnished with a blackboard, apparata of various kinds, as well as a reading and meeting table. The object of the room is to permit any one interested in radio to make it his reading, resting or meeting place. If he desires to carry on experiments, everything is available; if not in the room itself, it is but necessary to ask for any article desired and the clerk behind the counter will take it out of stock and put it at the disposal of the experimenter, whose only obligation is to return it when he has finished his experiments, and take good care of it.

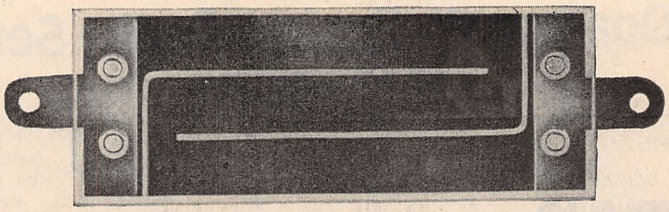
There are many advantages, which may

(*Continued on page* 414)

New Form of Resistance for Grid Leaks

By A. HENRY

WITH the increasing popularity and stability of the C.W. transmitter and an ever-increasing desire for outfits which do not sacrifice a part of their efficiency because of their compactness, we find that the tendency is toward a reduction in size of each unit which goes to make up the set with a very noticeable limitation of the dimensions of the complete layout.



This Type of Resistance is Not Influenced by External Conditions and is Especially Useful as Grid Leak or Standard Resistance for Radio Frequency Amplifiers, Shunts, Etc.

In the accompanying photo may be seen a new type of resistance unit which has been designed with this point in view and it is proving very satisfactory in all the rôles which have been assigned to it. This form of unit may be used in conjunction with impedance bridges, alternating current measuring instruments of all kinds, telephone and telegraph circuits, but it is especially interesting to radioists when used in a V.T. circuit as a grid leak.

The problem of producing a grid leak for transmitting tubes has long been an annoying one. Where there need be no thought given to the cost of producing such a unit, the problem is more or less simple, but the average experimenter, burning the midnight oil in an effort to learn and improve, is very frequently, though unfortunately, compelled to think of radio and its intricate puzzles in terms of available dollars and cents. In order to eliminate this bugaboo which stands in the way of radio progress many expedients have been tried. This factor of cost which means so much to the individual experimenter must be taken into account by the manufacturer of radio devices, for is he not the servant of the experimenter? This point has been very well taken care of in the design and construction of the unit we show here. Considering it from all angles, it may well be considered as one of the best developments of its kind which radio has seen in some little time. In addition to its low cost and small size it offers the further advantages of being simple to mount as well as pleasing in appearance.

The construction of the unit is unique and should be of great interest. On a strip of clear mica there is deposited a film of pure platinum or an alloy of platinum and gold. This is done by a chemical process. It is this film which acts as the resistor metal. By varying the length of the deposit the resistance is varied, assuming that the width

(*Continued on page* 414)

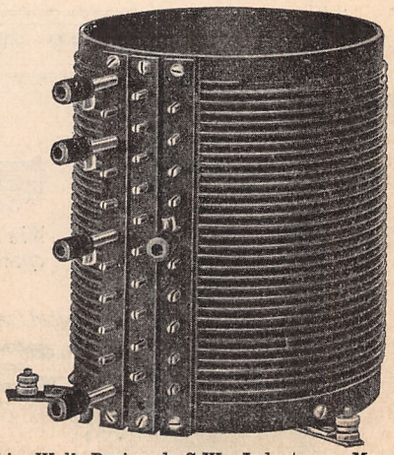
A New C. W. Inductance

SINCE the advent of C.W. telegraphy and telephony, there has been a demand for rugged, flexible and efficient C.W. inductances which differ very much from the common type of oscillation transformers used in spark sets.

A new type which has just been placed on the market consists of 30 turns of No. 12 B. & S. copper wire wound on a 5" slotted bakelite tube. Taps are brought out at each turn in the form of slotted studs, rigidly fastened to the wire and held in place by means of bakelite strips. With the inductance are supplied five terminals which may be plugged in any of the taps enabling the operator to vary the number of turns of each circuit separately. These terminals consist of pieces of brass tubing in one end of which is screwed a brass (rubber insulated) stud. A copper lugg for fastening leads is inserted between the bearing surface of the brass tube and the stud; the brass tubes are of the proper size to slip over the slotted studs, making a rigid positive radio frequency contact.

At the base of the inductance three feet are provided for fastening the inductance to the panel or base of the set. For those circuits which require a grid inductance, a separate coil smaller in diameter was designed so that it could be fixed inside of the large one. This grid inductance consists of 25 turns, tapped at 15 turns; it is wound on a 4" bakelite tube.

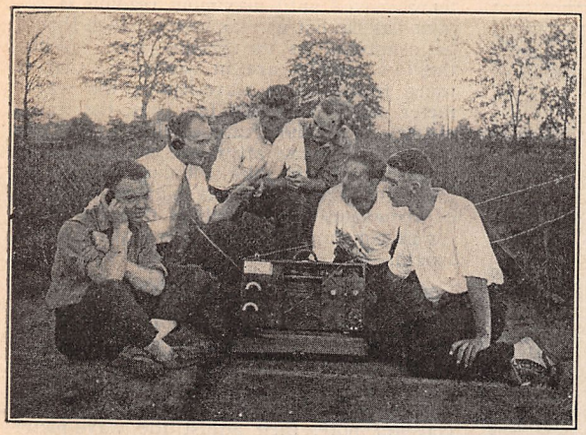
At the bottom of the cylinder are fastened three brass strips with binding posts and holes for fastening screws. By this means, three variations are possible, namely: 10, 15 and 25 turns, while the large plate inductance may be varied one turn at a time.



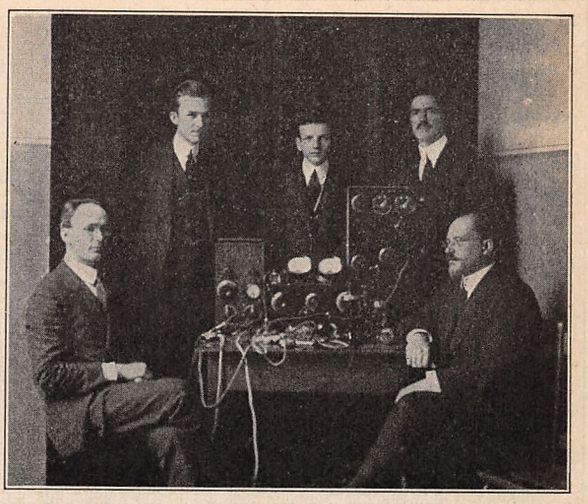
This Well Designed C.W. Inductance May be Varied One Turn at a Time and Good Contacts Are Insured by Plugs.

Radiophone in Costa Rica, C. A.

By W. SAGOT



In This Photograph May be Seen Mr. Sagot and His Receiving Set, Receiving a Radio Concert. The Amateurs Listening in the Set Had Never Heard a Radiophone Transmission Before.



On the Table is the Author's Set, Including a Radiophone Transmitter, Which Was Used for the Demonstrations.

PREVIOUS to my recent visit to Costa Rica, no work in the line of radio telephony had been carried out in that part of Central America. There is a low power spark station, owned by the United Fruit Co., at Port Limon, and a few amateurs scattered all over the central region of the country, with spark sets ranging from a Ford coil to a 1 K.W. rotary. The amateurs step on their keys every evening in an effort to fill the air with something else besides static and mosquitoes.

When I wrote announcing my contemplated radiophone experiments, the amateurs shined up their sets, turned over and over their crystals and the lucky owners of bulbs made a rush for the Eveready supply in town.

I had made no arrangements with any manufacturing concern and my intentions were simply to give a few demonstrations and lectures at some of the educational institutes. The receiving apparatus as well as the transmitter were home-made assemblages of standard parts. After the whole thing was put together, they looked like sample cases of the leading manufacturers. A Western Electric No. 329 transmitter taken from a wall set that had been down in the tropics for several months, talked with such convincing superiority that immediately it was engaged for a steady job in the transmitter set.

The transmitter was assembled using Colpitts oscillating and Heising modulating circuits, given over and over in practically every other issue of the various radio magazines. A clear diagram may be found in the Junior course of the June, 1921, issue of RADIO NEWS.

The receiving apparatus were of the variometer type with one and two stages of amplification. The diagrams are clearly shown in the January, 1921, issue of RADIO NEWS, page 443.

A 500-volt generator was used for the plates of a couple of U.V. 202 Radiotron tubes and an eight-volt storage battery was used for the filaments. A 44-volt "C" battery was required for the modulator, but some of my block batteries were spoiled in transit and I was unable to replace them. I used my last 22 volts for "C" battery and the modulator worked for about 50 hours with the plate at red heat until gases were delivered and blue glow appeared at 500 volts. The tube was, therefore, degraded from a modulator to an amplifier.

The impression caused by the radiophone experiments can be judged by the comments of the local newspapers.

Here is a short extract from "La Manana" of San Jose:

"THE PRESIDENT ACOSTA AND SOME OF THE SECRETARIES OF STATE ARE ABLE TO APPRECIATE THE EFFICIENCY OF THE WIRELESS TELEPHONE.

"President Acosta and some of his Ministers were invited to a lecture and a concert by Radiophone from "El Colegio de Senoritas." They were agreeably surprised by the clearness of the speech and the beauty of the musical notes transmitted through the ether."

This demonstration of the Radiophone seemed more surprising since none had been demonstrated before in Costa Rica, and several amateurs who attended the lectures were so enthusiastic about it that they immediately decided to build low-power Radiophone sets with information and data I gave them.

During the demonstration, while someone was in charge of the transmitter, changing the records on the phonograph, in which the microphone was mounted, I installed, a few

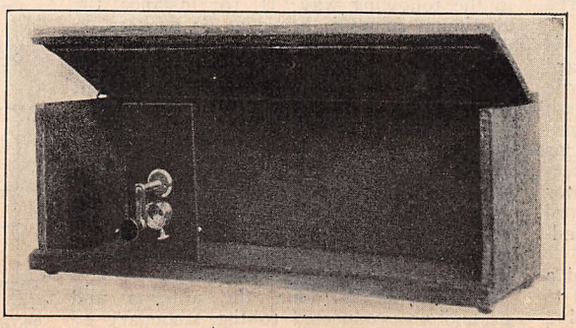
(*Continued on page* 434)

A New Standard Unit Panel System

THE unit panel type of receiving set which is finding increasing favor with amateurs, is, as is well known, an arrangement of panels of a uniform size on which the various instruments are individually mounted. The object of this is, of course, to enable the experimenter to make any changes, additions, substitutions, to "borrow" instruments for use elsewhere, etc., without disturbing the remainder of the set.

However, the writer has not yet seen a system which is sufficiently mobile to give it any great advantage over the ordinary style of cabinet instrument. The primary objection has been the necessity of screwing the panels to the cabinet; this results, usually in the screw holes getting worn so as to be useless after being used two or three times. Also, the amount of wiring which generally exists behind the panel is a further drawback.

The system described herewith appears to eliminate the defects described without detracting in any degree from the appearance. At Fig. 8 is shown a drawing of the cabinet, which is used with this system. As seen from the accompanying photograph, the cabinet is fitted with slots at the top and bottom front, and also, the top is mounted on hinges. The slots are made to suit the thickness of panel used, the lower one being a tight fit while the upper slot is made somewhat wider. It will be noticed that the ruler fixed behind the slot projects rather lower than the front edge so that when the panels are inserted and the lid is being closed, the panels are backed against this projection on the partly closed lid, thus bringing the panels into alignment before the lid is finally closed. A slight curvature on the lower inside corner of the ruler would further remove any difficulty on this score.



In This Type of Interpanel Set Any Instrument, Mounted on a Separate Panel, May be Removed in a Jiffy and Replaced by Another Unit.

We now come to the panels themselves, the salient feature of which is the pair of binding posts in each of the four corners. These binding posts consist of No. 8-32 x ½" Rd. Hd. brass machine screw, the head of which is placed on the outside of the panel. On the inside is screwed to this a No. 8-32 brass nut and a No. 8-32 brass battery nut. These parts should be nickel-plated and polished for appearance and efficiency. Any apparatus which is mounted on the panels need not be permanently wired thereto. Merely leave a short length of flexible cable from the instrument and solder on the end of a connector. These are then placed on the proper binding post on the panel.

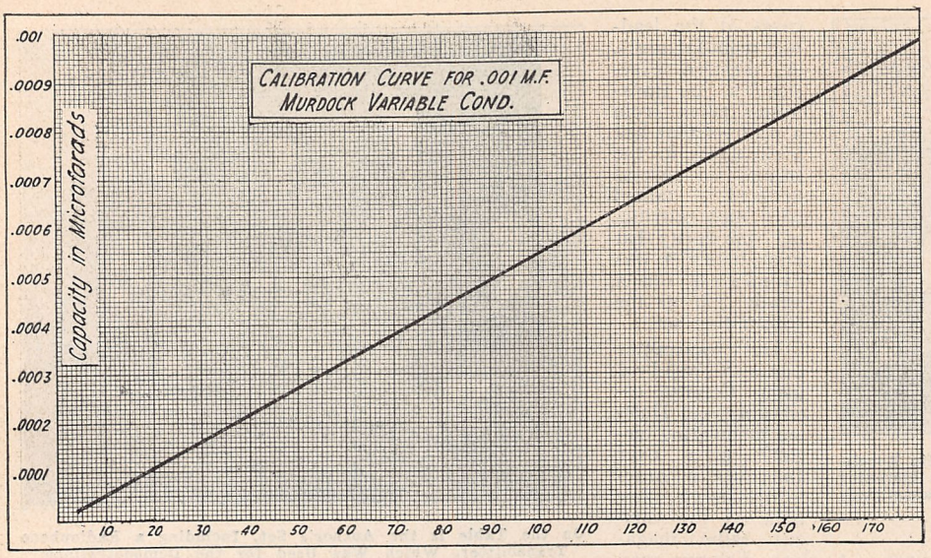
After the necessary binding posts are connected or short-circuited the panels are then inserted in the cabinet, and the set is ready for operation.

With this system each panel is made to carry part of the wiring of

(*Continued on page* 434)

How to Make and Use a Wave-Meter for Short Wave-Lengths

By ROBERT E. LACAULT



This Curve Shows the Value of Capacity, for Any Position of the Movable Plates, of a .001 MF. Variable Condenser.

WITH the coming DX season, several new apparatus appear on the market, but so far the wave-meters remain in the shadow, and I think that some real practical "dope" will be welcomed by many who still use the "guess" type of wave-meter to tune their sets.

First of all it should be remembered that, contrary to a popular belief among the amateurs, a wave-meter is not only used to tune the transmitter, but also to make several measurements often puzzling but in fact quite simple. If you have a little patience and intend to make your station efficient, read this article and make a wave-meter.

CONSTRUCTION OF AN AMATEUR WAVE-METER

A simple form of wave-meter with which any measurement may be made is shown in Fig. 1; as may be seen, it is composed of three circuits, L1 and K1 forming the calibrated circuit, L2 used as aerial coil and L3 being the listening circuit which can be coupled to the calibrated one. The constructional details of the various coils, as well as the method of mounting of the various parts in a cabinet, are shown in Fig. 4.

The inductance L1 is wound on a cardboard tube exactly 3" in diameter, and consists of 21 turns of No. 18 D.C.C. wire. The aerial coil, L2, which is wound on the same tube, ½" from the winding of L1, consists of eight turns of the same wire, with the tap at the fourth turn. The two ends and the center tap of this last winding are connected to the three binding posts marked A, as shown in the hook-up. This allows only one section of the whole winding to be used according to the desired value of coupling.

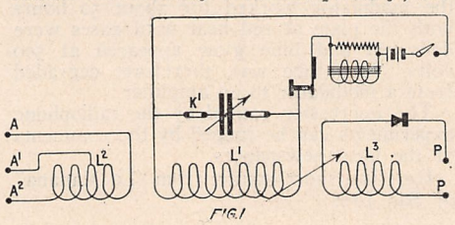
The coil L3, of the listening circuit, is wound on a piece of wood or cardboard tube 2" in diameter, and 1¼" long. A hole ¼" in diameter should be drilled through this form to mount a ¼" shaft. The winding of this inductance consists of 26 turns of No. 24 insulated wire, wound in two sections on each side of the shaft, as the rotor of a variometer. Two pieces of soft cord should be soldered to the ends of the winding for connection to the outside circuit.

On the top of the cabinet is mounted a "Mesco" buzzer, which may be adjusted to give a constant note, and on the panel a crystal detector.

In order that the calibration curve herewith given be used, it is indispensable that a 43-plate, panel type, Murdock variable condenser be used in the cardboard circuit; and that the inductance L1 is made exactly as described, otherwise the readings would be wrong.

HOW TO TUNE A SPARK SET

To tune a damped wave transmitter the aerial and ground should be disconnected and the secondary of the oscillation transformer moved away from the primary; the



Complete Hook-up of the Wave-Meter Described in This Article.

wave-meter is then brought near the set and the key pressed; after the detector is adjusted so that the spark is heard in the phones, the condenser is turned slowly until the sound in the phones is loudest. It will be found that this occurs at a certain point along the scale, and to find exactly at which degree it is sometimes necessary to loosen the coupling between the coils L1 and L3, so that the sound is just heard faintly at the maximum, that is at the resonance point of the circuits.

By referring to the curve, the wave-length of the transmitting circuit is found in the following way: If, for instance, the maximum sound is heard at 60 degrees on the scale of the condenser, follow towards the right, the line representing this number of degrees on the chart up to the point where it meets the curve, then by looking down under this point, the wave-length is found to be 210 meters on the horizontal scale. If the wave-length found is too high, the number of turns in the primary of the oscillation transformer should be reduced and another reading taken and so on, until the set is tuned to the desired wave-length.

When this is done, the antenna and ground are connected to the secondary of the oscillation transformer which is coupled to the primary and the contact of the antenna moved until maximum reading is obtained at the hot wire ammeter, which should be connected in the ground lead. When the two circuits are in resonance, that is tuned to the same wave-length, the wave-meter should be taken far from the transmitter and another reading taken to find out if two maximums are heard with the same intensity. If so, the coupling should be loosened slightly and the number of turns of inductance readjusted so that the loudest maximum found is on the desired wave-length.

HOW TO TUNE A C.W. TRANSMITTER

The tuning of a C.W. set is quite different from that of a spark station, and to adjust a tube set to a certain wave-length proceed as follows: First, start the buzzer and adjust it so that it gives a clear and constant note, then adjust the wave-meter on the desired wave-length by referring to the curve and connect a pair of phones to the binding posts marked P. Adjust the detector and loosen the coupling between L1 and L3, so that the buzzer is not heard too loudly in the phones.

The wave-meter being set, as explained, is then placed over the inductance of the C.W. transmitter and the set started; the tuning condenser of the C.W. set is then turned slowly until the sound of the buzzer becomes mushy, a very characteristic tone. The transmitter is then set on the wave-length to which the wave-meter was adjusted. The action of the wave-meter in this case is similar to what happens when a spark station is heard in regenerative sets, when the detector tube oscillates; the buzzer acting here as the spark station, while the C.W. set acts as an external heterodyne.

MEASURING THE NATURAL WAVE-LENGTH OF AN AERIAL

The natural wave-length of an aerial may be easily and accurately found with a wave-meter of the type described in this article by the following method: The receiver being connected, insert in the aerial lead in, one section of the aerial coil L2 and start the buzzer, the receiver being made apperiodic, that is connected as shown in Fig. 2. Then turn slowly the variable condenser until the maximum sound is heard in the phones at which moment the condenser shows the wave-length of the aerial, which is in resonance with the calibrated circuit. However, the value of inductance used in both primary and secondary of the receiver, should be very small, that is, only a few turns should be used, so as to add very little inductance in the aerial itself. The results found are exact, within a few

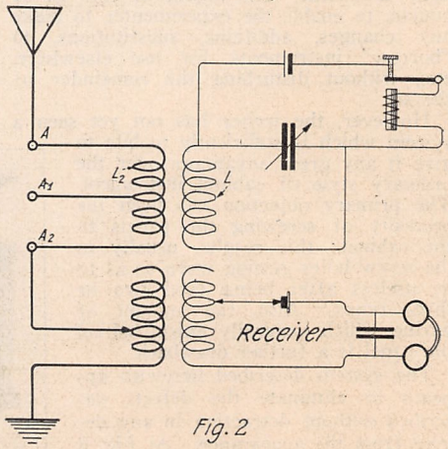


Fig. 2

This Diagram Shows How to Connect the Receiver and Wave-Meter to Measure the Natural Wave-Length of an Aerial.

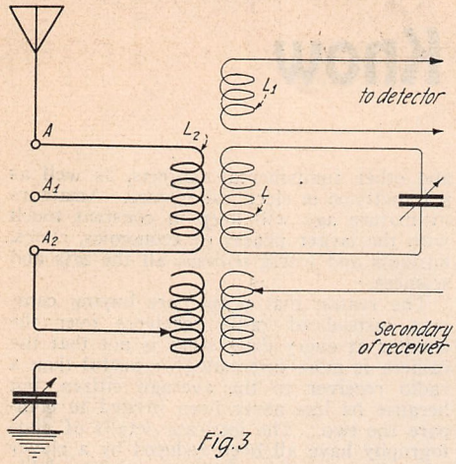
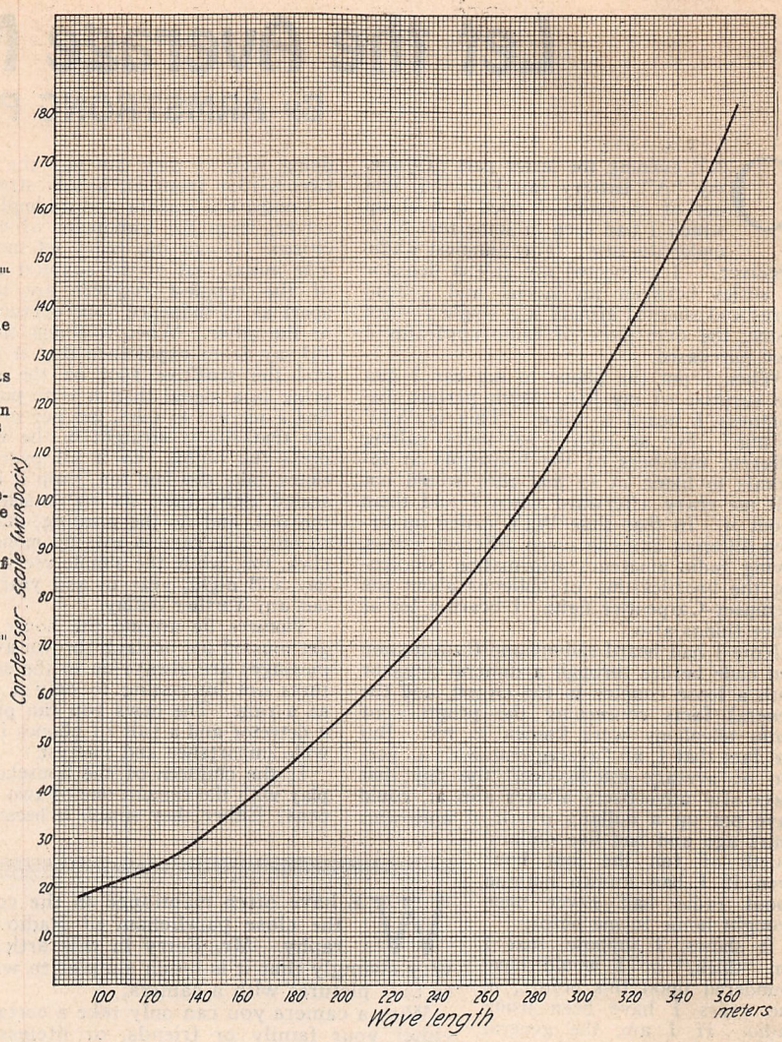


Fig. 3

On the left, Fig. 3, is the hook-up of the wave-meter used as interference preventer. On the right is the calibration curve showing the natural wave-length of the calibrated circuit for any degree of the variable condenser.



meters, which in practice is sufficient.

If the induction from the calibrated circuit to the aerial is insufficient to give a clear maximum in the phones, both sections of the coil L_2 should be used, and the coupling between the primary and secondary of the receiver made tighter; in any case, the listening circuit L_3 in the wave-meter should be loosely coupled to the calibrated circuit when not in use.

In order to determine if the wave-length found is that of the aerial and not the wave-length of the receiving circuit, some inductance should be added in the primary of the receiver, and another reading taken, which of course should read differently.

TUNING A RECEIVER FOR A CERTAIN WAVE-LENGTH

When a station sending on a special wave-length which is known in advance is to be received, the receiver can be tuned on this wave-length so as to prevent the missing of a part of the message while tuning the set during the first minutes of the transmission. This is especially useful when it is desired to receive a Radio concert, or some interesting transmission; it is done simply by starting the buzzer of the wave-meter and adjusting the condenser for the desired wave-length, the wave-meter being connected as previously, for the determination of the natural wave-length of the aerial. The receiving set is then tuned as for ordinary transmissions and is adjusted for the message to be received.

Once the receiver is tuned, the wave-meter may be removed from the aerial circuit, although it could be left connected if the buzzer is stopped, to be used as an interference preventer.

REDUCING QRM THROUGH THE WAVE-METER

In case it is difficult to tune in a station, owing to the heavy interference experienced in congested areas such as big cities, the wave-meter may be found useful to reduce the difficulties in tuning. It should be connected, as explained in the previous chapter, and the set tuned for the station to be received, then the detector and amplifier circuit are removed from the receiving set and hooked up to the listening circuit L_3 of the wave-meter, with the crystal detector short circuited if a V.T. detector is used. The calibrated circuit, then acting as an intermediate or filter circuit, makes it easy to tune in the station to be received if adjusted on the proper wave-length and provided the transmission is sufficiently strong.

FINDING THE WAVE-LENGTH OF A DISTANT SENDING STATION

Once the receiver of a station is adjusted carefully so as to be exactly tuned on a certain transmission, it is an easy matter to know the exact wave-length of the sending station; this is particularly useful these days to check the wave-lengths of amateur stations which are sending on anything but 200 meters. It is merely necessary to place the wave-meter near the receiving set, start the buzzer and move the condenser K1 slowly, until maximum sound is heard in the phones; the exact point of the maximum along the scale being found, the wave-length may be known by referring to the chart, as explained before.

For this purpose, it is desirable that Radio clubs make a wave-meter and inform their members of their wave-lengths, so that all the sets may be tuned within the limit prescribed by the law.

DETERMINING CONDENSER CAPACITY

When building a set, the amateur often wishes to know how to make himself the necessary condensers for his apparatus, and in most cases has not on hand the necessary data to calculate accurately the surface of the armatures or their number. The wave-meter then again can be used and gives more accurate results than any formula which may be employed, for it is difficult to know exactly the constant K of the dielectric and also the variations of capacity due to the pressure to which the condenser is submitted. Consequently, if you have a condenser, the capacity of which you want to know, disconnect the variable condenser of your wave-meter by removing the two connections S S^1, see Fig. 4, and insert in place the unknown capacity, then start the buzzer and tune your receiving set placed near by so that a maximum sound is heard in the phones; replace now the fixed condenser by the variable and, without changing the adjustment of the receiver, adjust the capacity of the wave-meter until you hear again the maximum sound. At this point, note the number of degrees indicated by the pointer of the condenser, and refer to the chart. Following upward the line from the number of degrees written at the bottom, which represent the scale of

(*Continued on page 434*)

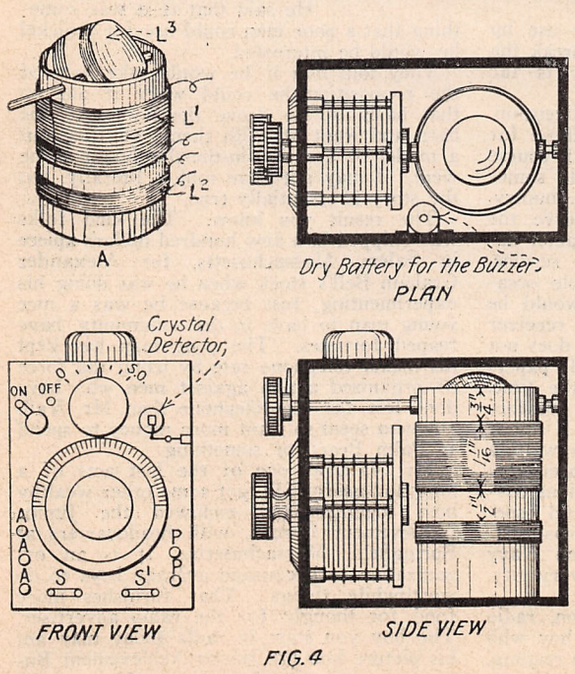


FIG. 4

Constructional Details of the Wave-Meter and Inductance Used. On the Front Panel, in the Upper Left Hand Corner May be Seen the Buzzer Switch.

Let the Average Man Know

By ARMSTRONG PERRY

ONE evening the latter part of June, my "A" battery ran low and, just out of curiosity, I tried a hook-up which I had seen in some text-book under the title: "The Simplest Radio Receiver." I connected my galena detector in series between my aerial and ground wires and shunted around it a single 75-ohm phone, the first piece of radio apparatus I ever purchased.

When I put the phone to my ear I met the surprise of my life. With perfect distinctness I heard a voice: "This is WJY calling." For an hour I sat there, calling different members of the household at intervals to listen in so that they would not call me crazy afterward when I told them about it. In that time WJY called up fifteen different cities in seven different States, giving radio amateurs information concerning the broadcasting of bulletins about the Dempsey-Carpentier fight. I heard a lot of other things also.

Now I had heard radiophone transmission and code before through a mineral detector with a loose coupler in the circuit, and the general facts concerning the progress of radio telephony were known to me. But the fact that I, an "average citizen," a "person of average intelligence," the guy that successful advertisers always aim at, could have put up a dollar's worth of apparatus years ago and had five dollars' worth of fun the first hour even if I had known nothing about radio had never been brought home to me before.

It shows, I suppose, that I am "thick," or I would have blundered upon this before, in the years I have been using radio. If I am, the general public is thicker, when it comes to radio, but the thickest, shortsightedest individuals of all are the fellows who spend their lives trying to sell radio apparatus and who have never told the public and me about this simple radio receiver.

It is a fundamental fact in business that about the first thing you have to do in creating a market for goods is to show people who know nothing about those goods what they can do with them and how easy it is to use them. This is especially recognized in "big business"—that is why it is big. Big business not only takes advantage of interest already created by its own efforts and those of others, but it constantly hammers away at the average man—the man who at present knows nothing about the product it is trying to sell—until he wakes up some morning with a feeling that he has been missing something and ought to buy immediately a cake of soap or a safety razor or whatever it is they are advertising. If he does not buy it that morning, they keep it before his eyes until he feels that he must have it in order to maintain his respectability. They teach him how to use it and what he can get out of it and they make it easy for him to buy it by having it in nearby shops or by keeping an easy-to-remember mail address in front of him. Are we doing that with radio?

Now I ask you, as a commons-ense proposition, why every home should have a camera, for instance, while not one in a thousand has a radio outfit? And incidentally why the leading corporation in the camera business should be big enough to command anti-trust law investigations and everything, while the good fellows who are trying to build up the radio business think they are doing well if they can pay the rent on a twenty-foot front on a side street

Compare a camera and a simple radio receiver, from the standpoint of the average citizen. Is not the radio set more useful? The initial cost of the simplest camera and of the simplest receiver are not so far apart as to influence your decision one way or the other. When it comes to operation, I'll say from experience that it is easier to find the sensitive spot on the galena and bring in a signal than it is to put in a film, find a picture to take, get her to stand still, see that she is straight in the view finder, press the button, do it all over again six times, take the film out, drop it before it is sealed tight, take six more snaps, develop the roll, and do the printing, mounting and so on. The camera eats up money at every click, too, while the simple receiver receives day and night, year in and year out, without any further outlay.

Pictures lie around the house, grow old, get mussed up, mislaid, thrown away. Radio messages are always up to the second. Pictures are interesting to only a few people as a rule. The news you can pick up with a detector and a pair of phones is of world-wide importance and interest.

If the children of the household want to play with the camera one of two things happens: Either they smash it because they do not know how to use it, or they use up films at a rate which threatens to break the family bank. The radio receiver is far more durable.

In relation to the duties of citizenship, the arguments for radio outweigh those for the camera a hundred to one. Of course every man and woman wants to do something for his community and country. Parents want their children to serve the public too, for the sake of the character development that comes from such service. With a camera it might be possible occasionally to get a picture which would be helpful, but with a simple radio receiver there is not a day in the year that does not present some opportunity. Local papers welcome the news, the jewelers the time, and everybody wants to get the weather forecasts earlier than they do.

The United States Navy is just waiting for the Boy Scouts and other amateurs to complete a system of receiving stations covering the country so that daily, and especially in cases of emergency, the broadcasting of important information from Navy stations will ensure its reaching every city, village and hamlet within the hour.

From the standpoint of education, radio again has all the best of it. The boy who uses it will get plenty of practice in reading, writing, arithmetic, geography, grammar, and other fundamental subjects, as well as a foundation in electrical science. Amateurs of mature age will keep in constant touch with the larger phases of economics, civics, business and world politics, all the arts and sciences.

The reason that people are buying cameras instead of radio receivers over the counter at every drug store is not that the camera is more interesting or useful than a radio receiver to the average citizen, but because he has never been invited to compare the two. The intricate details of photography have all been reduced by a clever advertiser to the alluring understandable slogan: "You press the button—we do the rest." The science of radio could be just as truthfully and compellingly epitomized: "Find the tickle spot and hear the World," but instead of making it simple and attractive to the average man radio advertising nearly always gives the impression that wireless apparatus can be used only by persons specially trained for the purpose.

I grant you that the camera business is a little older than the radio business, and has a right to be a jump or two ahead. The thing that worries me is that the radio advertisers do not seem to be making even a start towards getting the average man into the game. It is a great public utility, adaptable to every home, yet they advertise it as they would advertise block anaesthesia or any one of those things which concern specialists only.

We need a Theodore N. Vail in radio. Mr. Vail retired to a Vermont farm after spending all the years he wanted to in business. Big business men went after him, as they always do after a man who can see beyond his nose without a telescope. They had a promising new proposition, the telephone, a great thing for the use of rich institutions and wealthy people.

Mr. Vail said he was not interested and went on plowing.

They followed him down the furrow and asked him why.

He said that if it was something that a poor man could use for a nickel he would be interested.

They told him if he would take hold of the proposition he could work it out on that basis, so he drove the horses to the barn and went off with them, whittling out a model of a nickel-in-the-slot booth as he went. I may not have told it literally, but the story is essentially true.

The result you know. The kind folks who chipped in a few hundred dollars apiece in Salem, Massachusetts, for Alexander Graham Bell's stock when he was doing his experimenting, just because he was a nice young man to have in the community, have reaped fortunes. The poor man has kept his nickel telephone rate by using the force of organized action against men who have done less for the telephone than Mr. Vail, but who seem to want more money to spend at Palm Beach or something.

Mr. Vail, as one of the last acts of a long and useful life, got some other wealthy men together and endowed the Junior Achievement Bureau, with headquarters at Springfield, Massachusetts. It is an organization to encourage average boys to do worthwhile things. That furnishes more food for thought for the radio advertiser. The boy you start in radio today may get his picture into the Junior Achievement Bu-

(*Continued on page 416*)

WE have often mentioned in the columns of this journal the close parallelism of Radio and amateur photography. Mr. Perry in this article brings out the fact very strongly that it is much simpler to work a radio outfit than to take pictures with a camera.

With a camera you can only take a certain amount of pictures, either your family or friends, or lifeless objects, whereas by means of a $1.00 Radio outfit you can receive jazz music and hear all the latest news of the world free of charge. You can even set your watch by radio, if you so desire.

What the radio business needs now is an Eastman, one who can develop a radio outfit as Mr. Eastman developed the Kodak. When that happens, the amateur photography business will look insignificant alongside of the amateur radio business. Mr. Perry's article gives much food for thought.—Editor.

Radio Possibilities of the Tungar Rectifier

By M. L. SNYDER

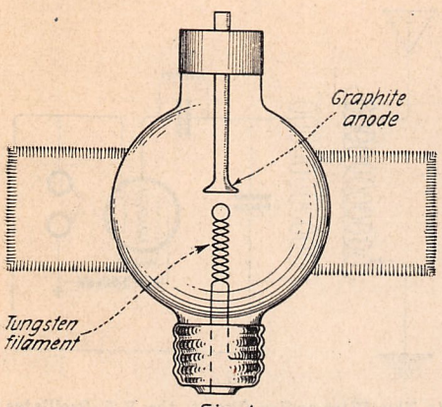


Fig. 1

Diagramatical View of a Tungar Rectifier Tube Filled With Argon Gas.

AS is well known in electrical circles, the Tungar rectifier, developed and manufactured by the General Electric Company, is a device for rectifying low tension alternation currents of commercial frequencies. It is a low voltage, high current tube, and is used principally for charging storage batteries, operating relays, etc., when only alternating current is available. This device, though primarily designed for low frequency alternating current rectification, has certain extremely peculiar properties which make it interesting from a radio point of view. This will be discussed in what follows.

A brief description of the Tungar tube will first be given: The Tungar rectifier is a two element gas-filled tube, consisting of a tungsten filament and graphite anode, Fig. 1. The tube is filled with argon gas which has the effect of increasing the electron flow. This is necessary because of the very low voltage used between plate and filament of this device. The glass bulb of this tube is usually discolored by a dark grayish-black deposit on the inside. This is due to a special preparation in the tube which is used to purify the argon gas.

The Tungar is made in various sizes and capacities. An intermediate size bulb has a bulb between 3" and 4" in diameter, and a two-volt, 20-ampere filament. The tube comes usually supplied with all the necessary accessories for rectification of A.C., and can be directly connected, for example, to the 60-cycle, 120-volt, lighting line, and be ready for use on the battery load. The circuit generally employed with the tube is given in Fig. 2. At the terminals AB, a rectified D.C. is available for whatever use required, as storage battery charging, relay control, plate voltage for vacuum tubes, etc.

It is found experimentally, that the Tungar rectifier has a peculiar characteristic whose form depends upon whether there is current flowing in the filament or not. Thus, suppose the rectifier connected in circuit as in Fig. 3 and the filament current set at a given value, if the plate voltage is gradually varied, by varying the field rheostat of the plate generator say, there will be a corresponding change in the plate current

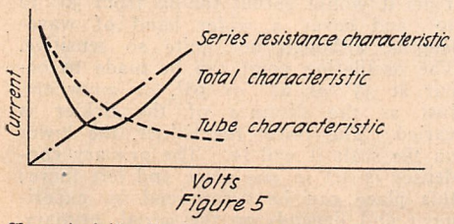


Figure 5

Characteristic Curve of a Tungar Bulb as a Rectifier.

and in the same direction as the plate current, and a characteristic curve of the tube similar to curve "A" of Fig. 4 will be traced. That is, while the filament is burning the characteristic of the tube is similar to that of regular electron tubes where an increase of plate voltage results in an increase in plate current. On this part of the curve the tube is, therefore, stable.

If the filament, however, is now extinguished at the point "A" on the curve, there will be a sudden change in the reading of the voltmeter across the tube, while the plate current remains constant. Varying the plate voltage will now produce a new characteristic curve "B" which is seen to be similar in appearance to the falling characteristic of the arc.

It is, therefore, seen that the characteristic of the Tungar rectifier consists of two parts: part "A" when the filament is burning, and part "B" when the filament is not burning. Part "A" is the stable portion of the characteristic, part "B" is the unstable portion of the characteristic. What probably happens is, that in the region "A"

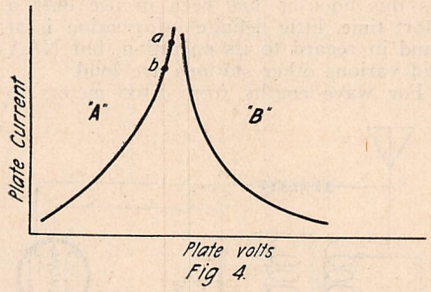


Fig 4.

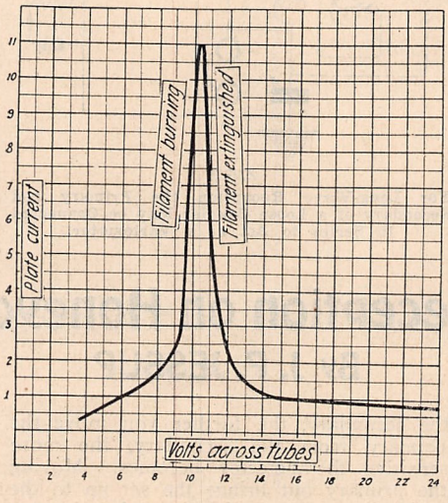


Fig. 4 Represents the Average Curve of a Rectifier. The Lower Characteristic Curve is That of a Tungar Tube Plotted for Various Values of Filament and Anode Potential.

where the filament is burning, an "arc" is struck, that is, the plate current is increased with increasing plate voltage until a value is reached where progressive ionization of the gas sets in. When the filament is extinguished, the plate voltage maintains this ionized state of the gas, and the filament is kept incandescent by bombardment of the gas ions, and thus curve "B" is formed.

A typical characteristic curve taken of a Tungar rectifier is shown herewith in the graph. Since the "B" part of the Tungar curve is similar to the "falling" characteristic of the arc and has, therefore, a negative resistance, the interesting question arises as

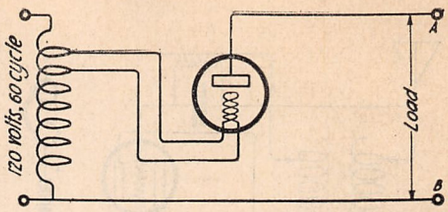


Fig. 2

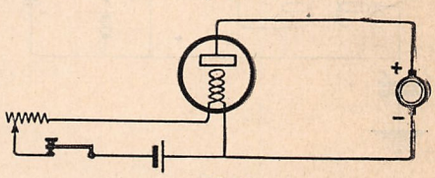


Fig. 3

Fig. 2 Shows the Regular Hook-up of a Tungar Tube Used to Rectify A.C., While Fig. 3 is the Diagram of Connections to Determine its Characteristic Curve.

to whether the Tungar rectifier can be made to oscillate.

Although the arc and Tungar rectifier are similar in their falling characteristics, there is one feature of difference between the two devices which is very important when the question of oscillations is considered. The arc, when it is struck, is immediately brought on its falling characteristic. In the case of the Tungar rectifier, it is first necessary to light the filament in order to strike its arc. That is, before the Tungar can be brought on its falling characteristic—where oscillations are possible—it is first necessary to bring it on the stable part "A" of the characteristic. When it is on the "A" part of the curve first, the filament must be extinguished and thus the tube is brought on the falling or unstable part of its characteristic. This makes considerable difference and introduces difficulties, as the following will show.

From the nature of the characteristic curves in Fig. 4 it will be seen that for any given plate current, as "B," the voltage across the tube when on the "B" curve is higher than when it is on the "A" curve. Hence, even when the tube is first brought to the "A" or stable curve, there must be available at the voltage source enough voltage to bring it on the "B" curve. Therefore, since the "A" period of operation requires a low voltage, it is necessary to insert resistance in series with the plate. Otherwise the plate voltage for the "A" curve will be too high, excessive plate current will flow, arcing and glowing will occur in the tube and the tube will be endangered thereby.

If this series resistance is too high, opening the filament circuit, in order to bring the tube on the falling characteristic, may not bring the tube on the "B" curve, for the resistance may consume most of the voltage, thus not leaving sufficient voltage across the tube as required by the "B"

(*Continued on page 410*)

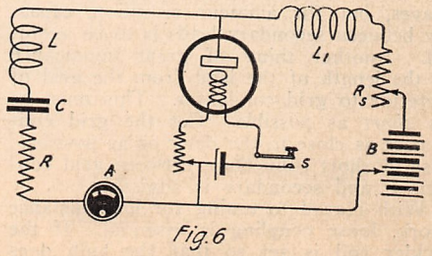
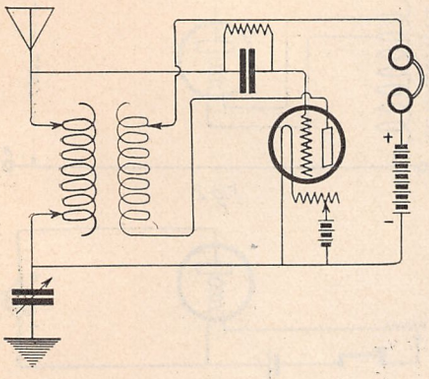


Fig. 6

It is Possible to Use a Tungar Rectifier Tube Instead of an Arc to Generate H.F. Oscillations. Here is the Hook-up.

The Loose Coupler in the V. T. Set

By L. DONALD KOONS



In This Circuit the Secondary is Used as Plate Inductance.

THE loose coupler has been gradually abandoned by more and more amateurs in favor of other tuning devices. Short-wave regenerative sets, honeycomb and duolateral coils and various other forms of inductances have taken its place. All these, however, are either restricted to a comparatively small range of wave-lengths, as the regenerative set, a number of them, as in the case of honeycomb coils, being used.

While their efficiency is undeniable, is there no way in which the loose coupler could be utilized to cover the entire field? This is the way the writer did it.

In the first place, the set used consisted of a 2,500-meter loose coupler (no dead end switches), a 43-plate variable condenser, phones (1,000 ohm), fixed grid condenser (.0005 mfd.), and one Audiotron with "A" and "B" batteries.

For short-wave work, the hook-up shown in Fig. 1 was employed. The secondary of the coupler was used as a tickler and the condenser in series with the primary.

This set has been in actual operation on amateur wave-lengths for only about two weeks. During that time four First district, seven Second district, 13 Third district, two Fourth district and 26 Eighth district amateurs were heard. XF-1 came in quite QSA. NSF was very loud on either phone or straight C.W. No amplifiers of any kind were used with either this hook-up or the two following. It should also be remembered that no dead end taps were employed on this coupler.

The tickler adjustment was very critical. Coupling had to be quite loose for amateurs and tight for 600-meter stations.

The "B" battery consisted of 13 two-cell flashlight batteries. It was not necessary to vary this voltage in any of the three hook-ups. A six-volt storage battery supplied current for the filament. No grid leak was used. This hook-up required the highest filament current of the three.

For some time no particular hook-up was used to cover the wave-lengths from 600 to 2,500 meters, but the ultra-audion circuit has finally been adopted. (Fig. 2). It is not a particularly good one, however, as spark stations do not come in on their natural tones on account of the vigorous oscillations produced by this circuit. Despite this objectionable feature, the signals are quite loud and not very difficult to copy. As this hook-up has been in use only a short time, little definite information is at hand in regard to its operation, but NAA and various other stations are loud.

For wave-lengths from 2,500 meters to 10,000 meters or longer, the hook-up shown in Fig. 3 was used. As the coupler functions here as a variometer, fine tuning could be secured by varying the coupling as well as the condenser.

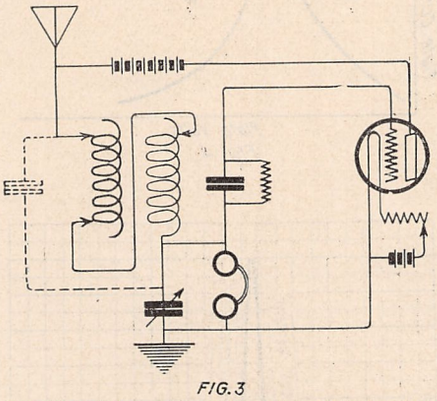


FIG. 3

For Long-Wave Reception the Primary and Secondary of a Loose Coupler May be Connected in Series to Act as a Variometer.

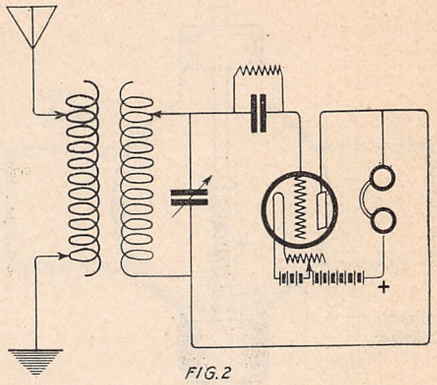


FIG. 2

In This Ultra-audion Circuit, the V.T. Oscillates Without a Separate Plate Coil.

Wave-lengths up to 6,000 meters were covered without the optional condenser; above this it must be used. On this set it consisted of three fixed condensers, one of three plates (tin) 4 in. x 6¼ in. separated by waxed paper, another of similar construction, but having three plates 4 in. x 13 in., and one of four plates, 4 in. x 13 in. These could be used either separately, in series, or in parallel. The maximum wave-length is unknown, but NAA (undamped) comes in without the optional condenser, and NDD with one section. Much higher wave-lengths could undoubtedly be reached with sufficient capacity. A large variable condenser would be more convenient here than the several smaller fixed ones.

In connection with this hook-up, the telephone line proved a very effective antenna for the longer wave-lengths. Signal strength was very greatly increased, as was the wave-length, to some extent. With all the sections of the optional condenser in parallel, WII and WGG could be heard plainly anywhere in the room. I have no data as to their wave-lengths.

(*Continued on page* 436)

Amateur Reception on Honeycomb Coils

By J. P. JESSUP

VERY little has been said concerning honeycomb coils for 200-meter reception. A number of amateurs, who never took the time to learn to use honeycombs, have discarded them and invested their money in expensive regenerative sets.

Now, in the first place, one thing that will surely kill 200-meter signals is capacity between the secondary leads. It does not make much difference for higher waves, but for amateur reception, capacity between secondary leads is to be avoided. Another thing of great importance is the length of the lead from the grid of detector to grid condenser. This must be as *short* as possible. Get the grid condenser as close to the detector as possible; also, a short connection between grid condenser and secondary is advisable.

With regard to tuning for long distance work, loose coupling is essential. If the tickler coil is set so that the bulb does not oscillate, but is close to the oscillating point, and the primary is pulled away from the secondary, the further you move the primary from the secondary, the more sensitive the detector becomes. Moving the primary out brings the set up to the oscillating point gradually, makes it very sensitive and cuts out nearby QRM to a great extent. It decreases the strength of stations within a hundred miles and increases the strength of those 500 miles and more away. This is considering honeycombs in connection with a two-stage amplifier. By setting the tickler at different distances from secondary, you can cause the bulb to start oscillating at any desired point on the secondary condenser scale. Suppose you have the tickler about ½ in. from the secondary and the primary about 2 in. from the secondary, there will then be a definite place on the scale where the bulb starts to oscillate. Call this place 40° on the scale. From 35° to 40° will be very sensitive to spark signals and from 38° to 40° will be supersensitive. If you have a vernier condenser across the secondary condenser, set the latter at 38° and the vernier at 0°, then tune on the vernier and you will find it very sensitive. The sensitiveness increases as you approach the oscillating point and far distant stations will be considerably amplified.

If you have not a vernier condenser, just tune carefully on the secondary condenser from 38° to 40°. A slight loosening of the coupling between the secondary and tickler will increase the region that signals can be heard in *lower* on the scale. Thus it would permit tuning from 30° to 40° and cover a wider band of wave-lengths, although not quite so sensitive. The oscillating point can be made to occur at 35° or 21° or 50°, or anywhere, just as the distance of the tickler is varied. The closer the tickler, the lower on the scale it will be. The primary condenser is set in one place and left there; this place can be determined by experiment and depends on the aerial, primary,

(*Continued on page* 436)

Groundless Wireless

By R. PREECE, Jr.

THE theory has lately been advanced that radio waves, especially those of long-wave length, travel along the earth's surface by pure conduction. Although the author does not wish to take any definite stand for or against this theory, yet by use of the circuit which is described in this article, it will be found possible to dispense with a ground entirely, and still obtain satisfactory receiving results on any wave-length.

The diagram of connections for receiving without a ground appears in the accompanying illustration.

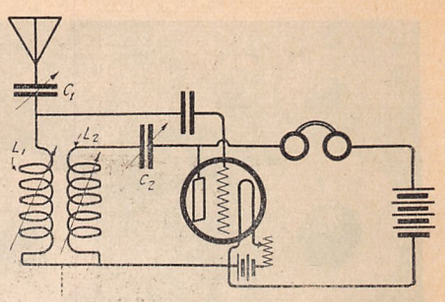
The size of the inductances L_1 and L_2 is dependent directly upon the wave-length on which it is desired to receive. For instance, if the experimenter desires to receive from the long-wave Trans-Atlantic stations, the two inductances should be of the honeycomb type, having about 1500 turns and being tapped at three or four places, to give a wide range of wave-lengths.

For the reception of the shorter wave-lengths, from 180 to 700 meters, the coil L_1 should be of 50 turns tapped at every five turns and the coil L_2 of 60 turns tapped at every 10 turns.

The operation of the circuit is exceedingly simple. The coil L_1 is the tuning inductance, by means of which the wave-length can be varied. The coil L_2 is the tickler coil, which will cause regeneration or oscillation, depending upon the result desired. The two variable condensers can be of the capacity .0005 to .001 microfarad. C_1 is the tuning condenser "tuning between the taps" of L_1. C_2 performs a two-fold function, that of coupling to the tickler and that of tuning the plate circuit. The tickler coupling can be said to be both electrostatic and electromagnetic.

The experimenter will find that the results on this type of receiver are gratifying in every respect. With the receiver of

(*Continued on page* 441)



With This Circuit the Author Claims That No Ground Connection is Necessary; and Signals Are Received With the Same Intensity as When One is Used.

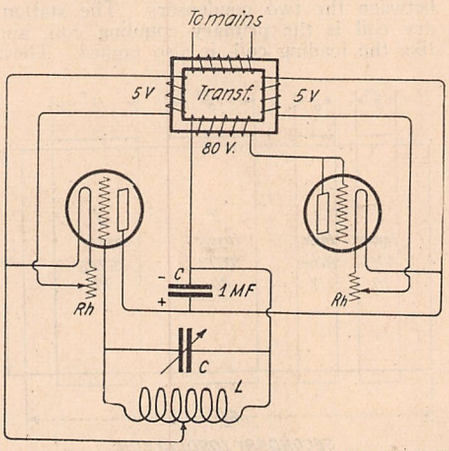
Heterodyne Reception With A. C.

By PROF. M. MOYE

WORKING up on the use of A.C. for reception purposes (see RADIO NEWS, June and August, 1921), I tried to build an heterodyne fed with A.C. from the lighting mains. Having got quite good results on C.W. reception, I hope the following description and diagram will enable any experimenter to rig up the hook-up.

L and C are variable inductance and capacity of the proper values for giving the necessary beats and are connected to the heterodyning value (on the left). A classical design which there is no need to dwell upon here. Now, the use of A.C. begins.

First of all, the V.T. has the filament heated by A. C. reduced to 5 volts through a proper transformer, a rheostat of a few ohms allows the right heating required for good reception. Then, the high tension (40-80 volts) on the plate is obtained from a rectifying valve (on the right) already described in these pages (see reference above). The fixed condenser, of one micro-farad, between negative and positive H. T. leads is essential, but its capacity is not at all critical.



This Separate Heterodyne, Especially Useful for Long-Wave Reception, is Entirely Supplied with A.C. Rectified Only for the Plate.

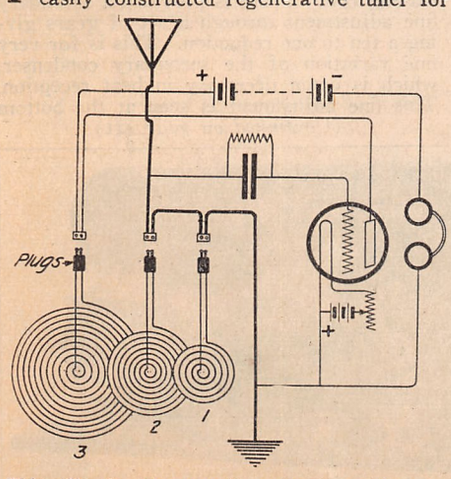
The diagram shows one transformer with three secondaries respectively giving low and high voltages. If preferred, separate transformers can be used with their primaries connected in parallel to the mains. They are perhaps, easier to find on the market.

The set is worked exactly as an ordinary heterodyne and C.W. are heard in very good style, no accumulators or cells being needed. One can object to the use of an extra valve for rectifying, but, in the long run, it is cheaper and easier to manage. Moreover, any true experimenter enjoys rigging up a new design and we believe ours is worth a little trial. This heterodyne can oscillate on any wave-length, according to the value of inductance and capacity CL. It may also be used as a short range C.W. transmitter.

The Simplest Regenerative Tuner

By R. McLEAN

I DESCRIBE here a very portable and easily constructed regenerative tuner for a vacuum tube detector. This set, in spite of its crudeness, is very satisfactory in operation. The absence of variable condensers makes the tuner portable.



This Simple Regenerative Receiver May be Made Very Compact and is Particularly Well Adapted for a Portable Set.

The diagram is practically self-explanatory: Coils No. 1 and No. 2 act as variometers and coil No. 3 is the reactance, all the coils being of the spider web type. The coils are laid partly upon each other and tuning is done by moving coil No. 1 over, or near to coil No. 2, while No. 3 is slipped far enough under its neighbor to provide the desired regeneration.

To cover the usual range of wave-lengths from amateur to Trans-Ocean stations, a series of coils is necessary. The number of turns on each coil is so arranged that the number of turns on the reactance coil is equal to the sum of the number of turns on the two smaller coils. For example, if coil No. 1 has 50 turns and coil No. 2 has 100 turns, then coil No. 3 will have 150 turns. Similarly, if we use coils having 100 turns and 150 turns respectively for the tuner, the reactance coil will require 250 turns.

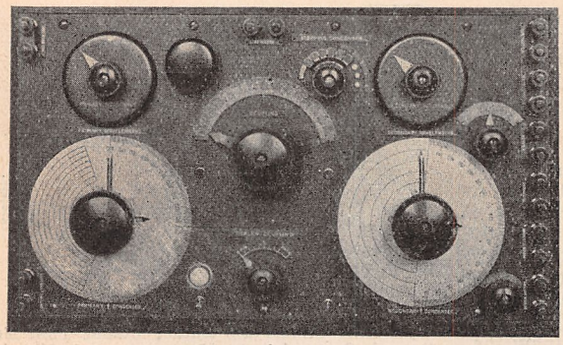
The coils are wound in formers (cardboard treated with shellac) with No. 28 D. S. C. copper wire. Three coils with 50, 100 and 150 turns respectively should bring in amateur stations on an average aerial. Continuing the series, larger coils will provide for the reception of longer waves.

An article on the construction of spider web inductances appeared in RADIO NEWS for April, 1921.

Each coil is provided with a plug to facilitate changing the coils. The sockets, three in number, are attached to a base which is provided with terminals for the connection of aerial ground and detector. To make the set less expensive, instead of using plugs (for you will require about seven coils if you want a good range of wave-lengths) solder half a snap fastener, as used on ladies' dresses, on to each lead from the coils and fix six of the portions of said fastener into which the other portion "snaps," to the base board. This is much easier to make than a cabinet set—give it a trial.

A Short-wave Receiver

By JESSE MARSTEN



This Efficient Short Wave Receiving Set Was Designed During the War for Use by the Navy and the Signal Corps.

ONE of the most important requirements during the war was a short-wave receiver for general use in reception, which could be turned out rapidly in large quantities and economically. At the same time, it was important that efficiency of reception be not sacrificed. The Type CM 294 Short Wave Receiver, as designed by the Marconi people, is a very good example of how the factors of efficiency, economy and quantity production were harmonized.

This receiver was specifically designed to cover the range from 250 to 3,100 meters, on a typical boat antenna having a capacity of 0.0008 microfarads and 55 micro-henrys inductance. Other requirements were that the design was to provide for reception with both crystal and valve detectors in both tuned and untuned conditions of the set. Provision was to be made for regenerative amplification, and for beat reception with oscillating valve. The methods whereby these were accomplished will be evident from the description following.

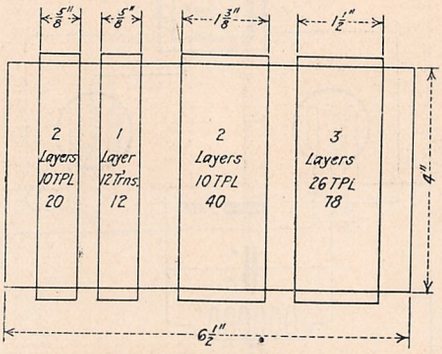
The front and rear views of the set shown here give all the details of construction and design. As seen, the set is a cabinet receiver, the over-all physical dimensions of which are as follows: Length 19½", height 11½", depth 9⅞". The weight of the receiver assembled is 35 lbs. The front panel is of dilecto, and the case mahogany veneered. All the parts and wiring of the receiver are made fast to the panel and base, so that upon removing the case, all parts and wiring are visible and accessible, thus facilitating repairs. All the units and controls on the front of the panel are provided with descriptive nameplates.

The circuits employed in this receiver comprise the usual primary and secondary circuits, the terminals of the secondary condenser being connected to the detector, valve or crystal. For regenerative amplification there is provided a tickler coil in series with the plate circuit, this tickler being inductively coupled to the grid or secondary coil of the receiver.

PRIMARY CIRCUIT

The primary circuit of the receiver is composed of a variable condenser, primary loading inductance, primary coupling inductance, and, if necessary, additional loading inductance. The primary loading inductance is wound on a 4" Natural Dilecto cylindrical tube, the wire being 3 x 16 x 38 Litzendraht. The coil is tapped at seven points, the tape being brought out to the primary inductance switch. It will be observed from the photograph of the front view that each tap is marked by a letter from A to G. On the taps from A to E inclusive, the primary condenser is in series with the antenna. On the last two taps F and G, the primary condenser is automatically thrown in parallel with the primary inductance. This is accomplished by the action of a switch mounted on the rear of the primary wave-length indicator cam.

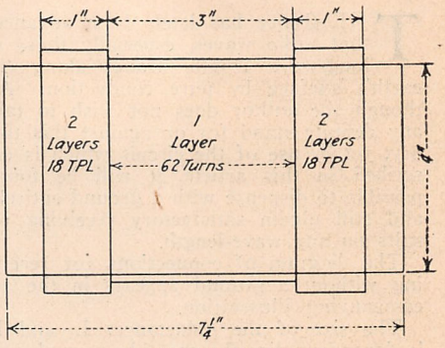
The coupler may be seen in the rear view between the two condensers. The stationary coil is the primary coupling coil, and like the loading coil, is also tapped. These coupling taps are brought out through a terminal block to the primary inductance switch. Thus, by using the primary inductance switch, variations in both coupling and loading are simultaneously effected.



SECONDARY LOADING COIL

This Sketch Shows the Repartition of the Sections of the Secondary.

The primary condenser is assembled with 5" diameter aluminum plates 32 mils thick. The maximum capacity of this condenser is about 0.0045 microfarads, about three times the antenna capacity. As seen from the front view, the top condenser plate is engraved with the usual condenser scale from 0 to 180, but at the same time it has engraved also a number of wave-length scales, one scale for each primary loading inductance tap. The inductance switch and special condenser pointer are mechanically connected by means of a cam arrangement, so that operation of the inductance switch automatically moves the wave-length indicating device to the proper wave-length scale. Underneath the condenser is a nameplate with an arrow, which indicates the reading on the condenser scale. The condenser is counterbalanced to prevent change of setting, counterbalancing being accomplished by means of the weight seen in the rear view.



PRIMARY LOADING COIL

Details of Winding of the Primary.

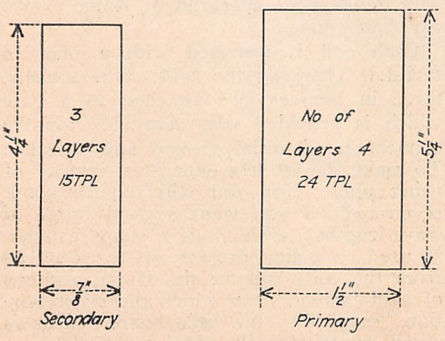
From the front view, a few further details of the primary circuit will be seen. At the left top will be seen two binding posts to which may be connected any external additional loading, should this be necessary. When not thus used, a short circuiting bus, as seen in the photograph, is ordinarily used instead. At the bottom left will be seen the antenna and ground binding posts. Across these binding posts is connected a small protective gap, to discharge local heavy static to the ground without injuring the receiver.

SECONDARY CIRCUIT

The secondary circuit is composed of secondary loading coil, secondary condenser and secondary coupling coil. The secondary loading coil is also wound on a 4" Dilecto tube, but unlike the primary coil, is not one continuous coil, but is wound in four distinct sections. The object of this type of winding is to reduce the distributed capacity and high frequency resistance of the coil. At the same time it necessarily keeps the natural period of the coil below the range of the receiver. This is extremely important as otherwise the coil will absorb considerable energy at wave corresponding to its natural. Also unless this absorption of energy is minimized in this way, it may not be possible to generate oscillations for heat reception.

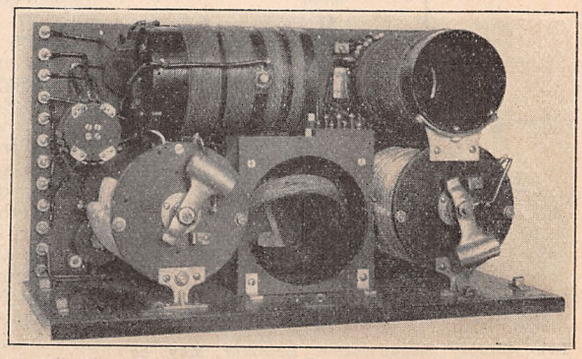
Like the primary, the secondary loading coil is tapped, but only at four points, marked on the secondary inductance switch from I to IV. The secondary condenser has a similar arrangement operating the pointer on the condenser scale, which has four wave-length scales engraved, corresponding to the four taps on the secondary loading coil. There is provided a secondary fine adjustment through a set of gears giving a ten to one reduction. This is for very fine variation of the secondary condenser, which is often necessary in beat reception. This fine adjustment is seen at the bottom

(Continued on page 441)



COUPLING

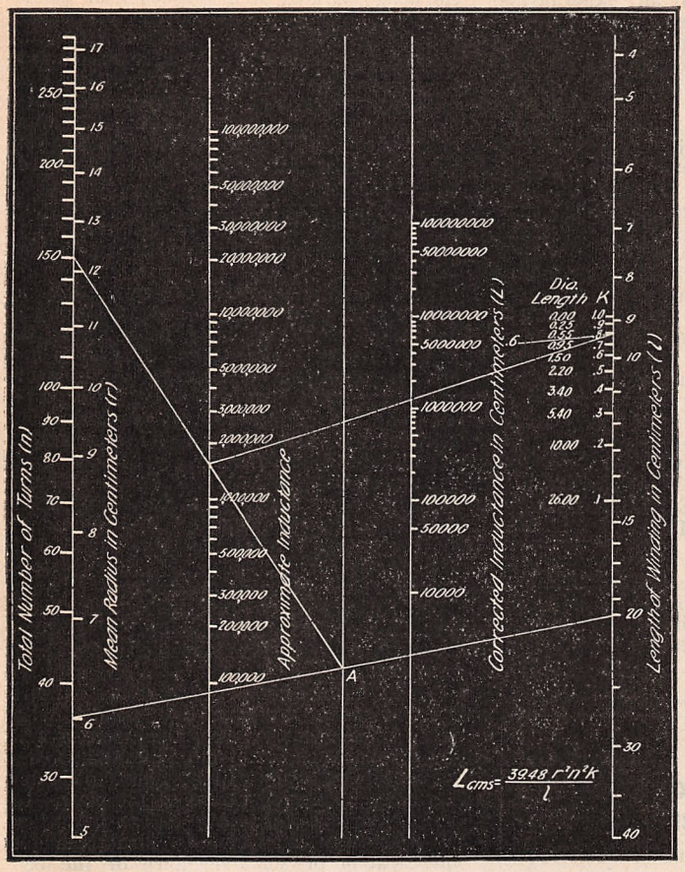
Dimensions of the Loose Coupler Are Given Here.

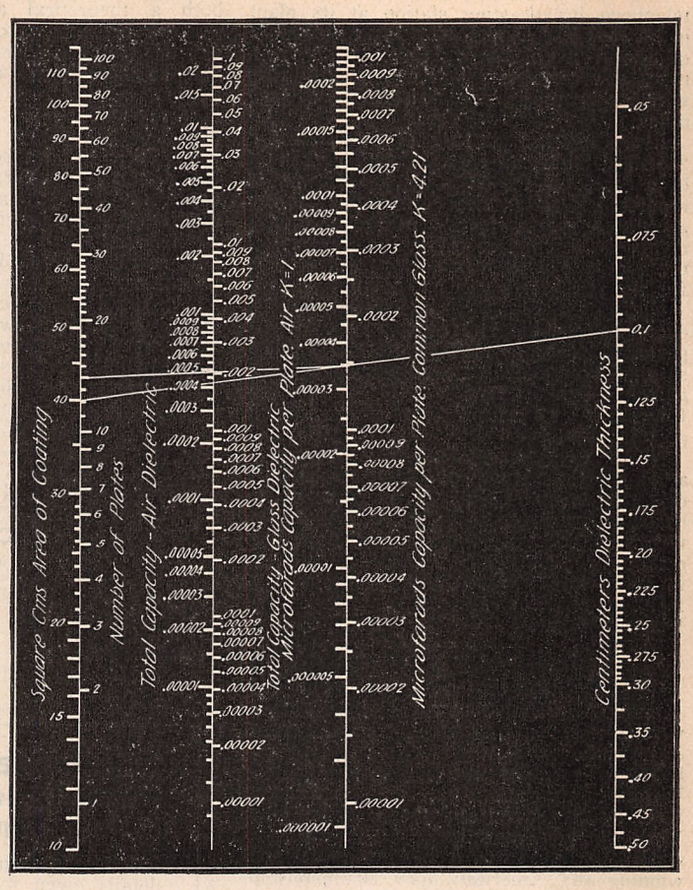


In This Back View of the Receiver May be Seen the Detail of Mounting. Note Balanced Condensers and Coils at Right Angles.

Monographic Charts for the Calculation of Capacity, Inductance and Wave-Length

By Z. W. VAN SLYCK





Here is Something Practical, Which Will Greatly Help the Amateurs to Determine the Inductance of Coils, Capacity of Condenser and Wave-Length of Circuits. Thanks to These Charts, All Complicated Formulae or Calculations are Eliminated, and They Should be Kept at Hand in the Station for the Measurements to be Made When Building New Apparatus.

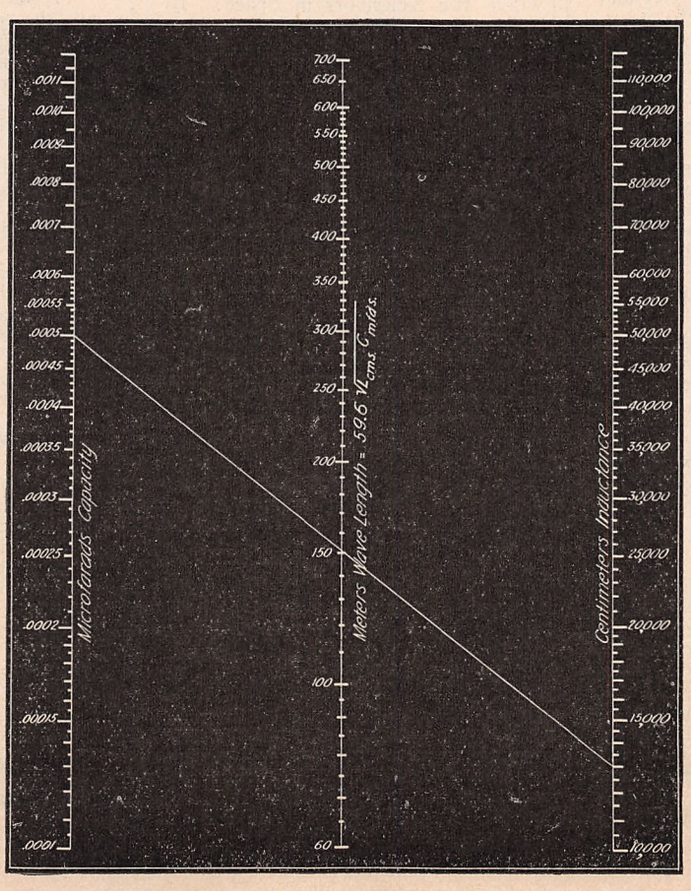
QUITE often the amateur wishes to make some calculations of inductance or capacity, or to measure the wave-length of a circuit, so that it will be able to tune up a certain station. The great obstacle is the use of formulae which are not familiar and look so complicated that they discourage the amateur in his attempts.

To simplify this and render easy any operation, the three charts which appear on this page were designed. With these charts it is possible to calculate the capacity of a condenser if the surface of the armatures is known and also to determine the surface of tinfoil and thickness of dielectric necessary for a certain capacity. For the calculation of inductance, no operations are necessary, and the value of any coil may be found in centimeters if the dimensions and size of wire are known. The third chart gives the wave-length of any circuit, when the capacity and the inductance are known.

The following examples show how simple it is to use these charts:

CALCULATION OF THE CAPACITY

Suppose we wish to construct an air dielectric condenser whose maximum capacity will be .0005; suppose we decide that the safe separation between plates is 0.1 cm., that is 1 millimeter, and that the size of our plates will permit an area of 40 sq. cms. Referring to Chart 1, on the right, we connect the points 0.1 on the right with 40 on the left, and read .000035 on the center scale, which is the capacity per plate. Connect this point with the required capacity, in this case it is .0005 on the left center scale, and extend the line to the left scale, where we read 12, which is the required number of plates.



CALCULATION OF THE INDUCTANCE

Now suppose we have a tube upon which we can put a winding of 150 turns in 20 cms., and the mean radius of a turn will be 6 cm., connect 6 on the left of Chart 2, on the left of this page, with 20 on the right scale and mark intersection on the reference line, point A in this case. Connect A with 150 on the left and on the left center scale read 600,000 cm. inductance. Connect this point with .6 (12/20) on the right, and read a corrected inductance of 1,300,000 cms. on the right center scale.

It may be mentioned that one inch is equal in length to twenty-five millimeters and four-tenths, or two centimeters, five millimeters and four-tenths.

CACULATION OF WAVE-LENGTH

The chart for the calculation of the wave-length, which is at the bottom of this page, is similar to one appearing in another issue of this magazine, except that only a single setting is required, the constant 59.6 being incorporated in one of the scales.

For instance, if, in a circuit having an inductance of 13,000

(*Continued on page 439*)

Radio Digest

DAILY NEWS AND CONCERTS BY RADIO TELEPHONE.

The Westinghouse Co. has opened a radio telephone broadcasting station at its plant in Newark, N. J., and, with the coöperation of the *Newark Sunday Call*, is supplying news and concerts which can be heard by wireless operators within a radius of 200 miles.

Every night, beginning at 8:05 Eastern Standard Time, an entertainment consisting of a digest of the day's news, Government reports and a musical entertainment are given. A special feature of the entertainments is a children's hour every Friday night at 7 o'clock, when songs and stories for the youngsters will be radiophoned.

During the World Series baseball games, every ball, strike and other play was reported, as soon as made, from this station, so that thousands were able to enjoy the games. Similar service will be provided for the major football games and other important events.

The Westinghouse Newark station operates on a wave-length of 360 meters and its call letters are WJZ. It should be easily heard as far south as Baltimore and as far north as Albany, while under favorable conditions, the messages should be audible in practically the entire area east of the Mississippi River, and as far east as the Bermuda Islands.

TIMES OPERATOR GETS PRIZE FOR WINNING CODE CONTEST.

Hundreds of amateur radio telephone and wireless telegraph operators within a radius of 200 miles of New York a short time ago heard officials of the National Amateur Wireless Association present a silver cup to B. G. Seutter, wireless operator of the New York *Times* Transatlantic radio receiving station. Mr. Seutter received the cup for winning the American open championship. He received code at forty-four and one-third words a minute with no mistakes.

The presentation was held in connection with the New York Electrical Show in the Seventy-first armory. The wireless telephone was used to spread the addresses and reception speeches to members of the Association. Major Andrew White, President of the National Amateur Wireless Association, in formally awarding the cup, pronounced Mr. Seutter's work "a remarkable achievement of one hundred percent. perfection."

Arthur Williams, General Manager of the New York Edison Company, which donated the cup, was specially connected with the armory by wireless telephone at his home, where he was confined by illness.

TWO TOWERS COLLAPSE AT LYONS.

Two towers of the great wireless station at Doua, a few miles from Lyons, collapsed recently, killing one person and wounding two others. The station probably will be out of service for some time.

THE DETECTING EFFICIENCY OF THE RESISTANCE-CAPACITY COUPLED ELECTRON TUBE AMPLIFIER.

By E. O. Hulburt.

The detecting efficiency of the electron tube amplifier means, in general words, the efficiency of the amplifier to make weak signals intelligible. From general considerations it can be seen that the detecting efficiency depends upon the relation between the input grid voltage change, and the resulting change in the output plate current. This has already been discussed in two papers, one of which dealt with experimental measurements of the detecting efficiency of a three-tube high-frequency transformer-coupled amplifier, and the other with the detecting efficiency of the single electron tube; this last considered the question from both a theoretical and an experimental standpoint. In the case of the high-frequency transformer-coupled amplifier the detecting efficiency was defined by the relation $\lim_{A \doteq 0} b_0/A^2$ where A and b_0 are the amplitudes, respectively, of the input grid potential and of the rectified component of the output plate current. In the present paper is described an investigation, both theoretical and experimental, of the detecting efficiency of the high frequency resistance-capacity coupled amplifier. A theoretical analysis, in which certain simplifying assumptions were made, has been carried out, which showed how the detecting efficiency depended upon the constants of the coupling circuits. Experiments were then performed to obtain data on this type of amplifier, and to test the theoretical relations.—(*Physical Review*, No. 3, Vol. 18.)

NEW METHODS FOR MAINTAINING CONSTANT FREQUENCY IN HIGH-FREQUENCY CIRCUITS.

By W. G. Cady.

As stated in a former communication, a plate properly cut from a piezo-electric crystal and provided with metallic coatings vibrates mechanically when the coatings are connected to an E.M.F. of high frequency, provided that the frequency is sufficiently near the natural frequency of mechanical vibration. The absorption of energy gives the plate an effective series resistance which is a maximum at the resonant frequency. The effective parallel capacity of the plate is a maximum at a frequency slightly below resonance, and a minimum at a frequency slightly above resonance, passing through the normal value at resonance. The total range in capacity is greater, the less the vibrations are damped, and in the case of quartz it may be more than twenty times as great as the normal capacity of the plate. The accompanying change in frequency may be a very small fraction of a percent.

This dependence of capacity upon frequency may be utilized as a frequency stabilizer, by simply connecting the piezo-electric plate in parallel with the tuning condenser of an ordinary vacuum tube oscillating circuit. When the frequency is slightly above that at which the plate is in mechanical resonance, an increase in the capacity of the variable condenser is accompanied by a nearly equal decrease in the effective capacity of the plate, so that the frequency remains constant within exceedingly narrow limits. If the condenser reading is increased beyond an amount corresponding to the maximum plate capacity, the plate suddenly stops vibrating, and the frequency abruptly decreases by a large amount. A similar process, in the reverse sense, takes place on decreasing the capacity of the variable condenser.

For example, a certain quartz plate 3.9 cm. long vibrated at a frequency of about 69,700. A change in the variable condenser which, when the quartz plate was removed, altered the frequency by 3 percent., varied it by less than one part in 20,000 when the quartz was in circuit. This plate had coatings so small that its normal capacity was only about 0.67 micro-micro-farads; yet when vibrating, its effective capacity varied from 10 to —9 M.M.F.

A similar stabilizing effect can be obtained for any frequency over a very wide range by selecting a plate of the right length.

Two other methods of connecting a quartz plate may be mentioned, which under favorable conditions have been found to exert an even more marked stabilizing influence upon the frequency. In one of these, the plate is provided with two pairs of coatings, one pair being connected in parallel with the tickler coil in the anode circuit, the other in parallel with the grid condenser and leak. If the circuit without the plate is on the verge of oscillating, then when the plate is introduced, the vibrations of the quartz furnish the "feed-back," and the circuit oscillates at a frequency determined solely by the plate itself. By a proper choice of circuit constants, the plate can be made to vibrate at either the fundamental frequency or the second or third harmonic.

In the third method, the plate has but one pair of coatings, connected in parallel with the grid condenser and leak. Here again, by a suitable choice of circuit constants, the electrical frequency will be found to be determined by the vibrations of the plate. In this, as in the other methods, the frequency is practically unaffected by small changes in capacity or self-inductance of the circuit.—(*Abstracted from the Physical Review.*)

Radio Articles in the November Issue of Science and Invention

A Yacht Radiophone—Full Circuit details given for a complete radio telephone, C.W. and I.C.W. transmitting set. Outfit uses two 75-watt vacuum tubes. By C. Golden.
Arc Welding of Audion Parts. By F. A. Anderson.
Have We Neighbors in Space? By Ivan L. Smith.
Question and Answer Column.

PRESIDENT HARDING TO OPEN NEW RADIO STATION.

President Harding will address practically all the peoples of the nations scattered throughout the civilized globe in one message which will be sent broadcast by radio on November 5 from the newest and largest wireless station in existence.

The arrangements were concluded recently during a personal visit paid to the President by David Sarnoff, general manager of the Radio Corporation of America. The occasion will be the opening of the New York radio central situated near Port Jefferson.

The station will be officially opened by the President, who will send his message from Washington over a land wire which will control the apparatus at the central station and fling the words out through space over an area which includes all the important nations of the world.

LIEBMAN PRIZE AWARDED TO RADIO ENGINEER.

The Morris Liebman Prize, the cash award made each year by the Institute of Radio Engineers to that member of the Institute who is considered to have made the most important contribution to radio art during the preceding twelve months, has just been awarded to R. H. Heising, of the Engineering Laboratory of the Western Electric Company, "for his analysis of vacuum tube action and his research work on modulation systems."

In commenting upon the award, Dr. F. B. Jewett, Vice-President and Chief Engineer of the Western Electric Company, said: "Mr. Heising has long been a member of the Research Department, and for the last

(*Continued on page* 443)

Who's Who in Radio

JAMES ERSKINE-MURRAY, D.Sc., F.R.S.E., F.I.R.E., F.I.P., M.I.E.E.

JAMES ERSKINE-MURRAY was born October 24, 1868, in Edinburgh, and was educated by private tutors and at the Universities of Glasgow, under Lord Kelvin; Cambridge, under Sir J. J. Thomson; and Berlin, under Professor Kundt. During 1896-8, he was assistant professor in physics and lecturer in electrical engineering at the Heriot-Watt College, Edinburgh, University College at Nottingham and the Technical College at Paisley. He also lectured on Radiotelegraphy at the Northampton Institute, London.

From 1898 to 1900, Mr. Erskine-Murray was chief experimental assistant to Sr. Marconi, and developed with him various types of antennae for portable sets and high power stations, although at the time the only source of high tension used to supply the oscillating circuit was a spark coil. A type of aerial which was, in fact, a condenser aerial, consisted of two huge pipes made of zinc plate installed at the top of a truck in which were mounted the apparatus; one of these pipes was the antenna, while the other one acted as a counterpoise. They were about 15′ high by about 2½′ in diameter, and were installed vertically with guy wires to support them.

The range obtained with such antennae was not great, owing to the poor sensibility of the receiving devices used in those early days of Radio. The receiving set consisted of the coherer, a relay and all the accessories necessary to operate a Morse inker, enclosed in a metallic box which was grounded to protect the receiving set from the strong discharge of the sending apparatus consisting of a plain zinc gap mounted on a spark coil.

Mr. Erskine-Murray also developed with Sr. Marconi the tuning instrument of the

Mr. James Erskine-Murray, a Pioneer in Radio and Inventor of Several Devices.

receiving circuit, the characteristic of which was kept secret at the time, and which was but a loose coupler, with the secondary wound in two sections.

During the year 1905 he lectured on electrical engineering at the George Coates Technical College, Paisley. Following this, he established in 1906 a business of his own as consulting engineer in Radiotelegraphy, and lectured on that subject at the Northampton Institute, London, from 1907 to 1911, contributing papers to numerous societies.

A partnership was formed in the year 1913 with the Submarine Cable Consultants, Messrs. Clark, Forde and Taylor, of London. Mr. Erskine-Murray has been consulted by and has advised the Army Council, the Pacific Cable Board, Lloyds Association of Underwriters, the U. K. Chamber of Shipping and almost all the well-known European Radiotelegraph companies.

James Erskine-Murray joined the Royal Naval Volunteer Reserve in 1917, with the rank of Lieutenant-Commander and is now in charge of Radio Experiments and Design, for the Royal Air Force at the Air Ministry, London, England. Several of the up-to-date aircraft Radio sets among which the low power, two-tube combined transmitter and receiver and Radio telephone set, may be mentioned, are the results of his work. This set is quite light in weight and fulfills the requirements of a complete instrument for use aboard the airplanes. The special receiver and the Radio compass for use on aircrafts were also developed and improved by him.

A large number of other researches have been carried on by him and his inventions in Radiotelegraphy are numerous, particularly in connection with directional transmission. He is the author of several interesting books on Radio.

The Meeting of the Technical Committee on International Radio Communication

First Public Report of the Decision Taken by the Committee at the Paris Meeting

By S. R. WINTERS

THE conclusions of the Technical Committee on International Radio-Communication, composed of representatives from the United States, France, Great Britain, Italy and Japan, are for the first time disclosed to the wireless fraternity and the public in the article which follows. The meeting was held in Paris, extending from June 21 to August 22, 1921, during which time answers to fourteen questions of world-wide concern to the development of wireless telephony and telegraphy were answered. These inquiries, in the form of technical questions, were formulated at a conference previously held in Washington, but answers to which were deferred in interest of deliberation by the international technical committee.

Nomenclature, or a system of names by which radio communication could be best explained, received first consideration of the Technical Committee on International Radio-Communication. This action was deemed essential as a means of lending clarity and system to the proceedings of the meeting as well as standardize technical terms for the guidance of the radio fraternity. The French-English terms thus agreed upon are, however, subject to the final action of the International Electrotechnical Commission at its next meeting. "Statics" or "X's," now of frequent use, is a term tabooed by the committee, the words "Atmospheric Disturbances" being substituted therefor. Where repeated references to this condition in radio communication are necessary the word "Disturbances" or "Atmospherics" is permissible. Instead of employing the popular designation "Wireless," the terms "Radiotelegraphy" and "Radiotelephony" are recommended. "Triode" was adopted as the specific name for the ordinary three-electrode tube, and when the triode is used in one of its conventional ways, these terms are suggested, "Rectifier, amplifier, or generator triode." The "Electron Tube" is recognized when employing any number of electrodes in any of its various operations. When referring to couplings of antenna systems, or of triodes these descriptive words may be applied, "Resistance, Inductive, Auto-inductive, Capacity, or Capacitive Coupling." An instrument for determining the direction of propagation of waves is to be identified as either a "Direction Finder" or "Radiogoniometer." The word "Antenna," now frequently applied to a multitude of things, is described as the electrical conductor, or system of conductors, for receiving or emitting electromagnetic waves. This designation does not recognize the mechanical supports which may edge about the antenna. These "props," so to speak, are divided into two classes. For self-supporting structures, use the word "Towers," and for those structures where there is an absence of self-support, "Masts" fittingly describe them. It is not permissible to merely use the word "Coil" when referring to a "Coil Antenna." The "Radiation Height" of an antenna was defined as numerically equal to half the length of its equivalent doublet. The notable discovery of Major General George O. Squier, popularly known as "wired wireless," may be changed to the "Squier System of Telegraphy and Telephony." France, Great Britain and Italy already employ the terms "high frequency telegraphy" and "high frequency telephony." When writing numerical values of frequencies, in terms either of cycles-per-second or of periods-per-second, these abbreviations are permissible: For cycles-per-second, c/s; kilocycles, kc/s; Megacycles, Mc/s; for periods-per-second, p/s; kiloperiods, kp/s; Megaperiods, Mp/s.

Question number one, with which the Technical Committee on International Radio-Communication concerned itself, involved a classification of waves, definitions of the same, and deviations therefrom, which will be tolerated in practice: The types of waves are: A—Continuous waves; A1—continuous waves, key modulated; A2—Continuous waves, modulated at an audible frequency; A3—Continuous waves, modulated by speech; Type B—Damped waves. Definitions of these types follow: Type A—Waves which, after reaching the steady state, are periodic; that is, the successive oscillations are identical; A1—Continuous

(*Continued on page* 448)

High Voltage Dynamos

How to Rewind and Rebuild Low Voltage Dynamos so as to Produce High Voltage D.C. for Vacuum Tube Radiophone and Radio Telegraph Transmitters

By H. WINFIELD SECOR, A.M.I.R.E.

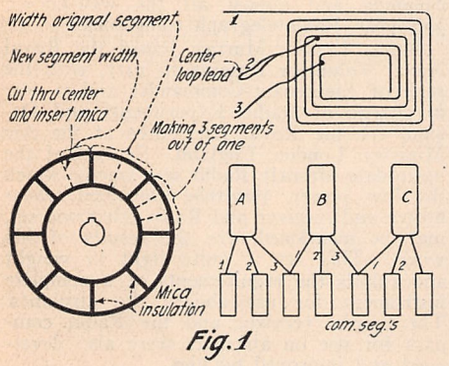


Fig. 1

If a Dynamo is Rewound to Deliver a Higher Voltage for a Radiophone Set, and the Commutator Made With More Segments, the Coils Should be Wound and Connected as Shown Here.

HIGH voltage direct current dynamos, with a rating of anywhere from 100 watts up to 1,000 watts or more, have come into considerable demand, due to the rapid development in continuous-wave radio telegraph and radiophone transmitting sets. With a little care and design an ordinary dynamo wound for 110 volts or more, such as can be purchased on the open market, either brand new or second-hand, can be rewound so as to give a higher voltage, say two to three times the original potential for which it was wound. The three main factors which concern us in rewinding a dynamo for higher voltage than that for which it was originally designed are: The proper insulation of the wires and coils on the armature to prevent breakdown of the winding due to the higher voltage present; there shall be a sufficient number of commutator segments to keep the potential difference across any two adjacent segments down to a value of 30 to 40 volts, if possible; and the third factor with which we have to conjure is the excitation of the field. Where we have a separately excited field, as shown diagrammatically at Fig. 3, the problem is of course easily taken care of, for no matter what voltage we rewind the armature for, the field coils can be excited at the usual potential of, say, 110 volts.

Where a 500-volt dynamo is to be converted into a machine giving about twice the original potential or 1,000 volts, the number of commutator segments is sometimes left the same as originally and only the winding is changed.

The simple rule for rewinding armatures for different voltages is as follows: The number of turns of wire in each coil varies directly with the voltage, while the cross-sectional area in circular mils (abbreviated C.M.) varies inversely as the voltage. For example, if one of the armature coils on a 110 volt armature has 50 turns of 200 C.M. wire, then if this armature was to be rewound for 220 volts, the coil would be changed so as to contain 100 turns of wire having one-half the cross-sectional area of the original conductor or 100 C.M. As will be seen this allows the greater number of turns of proportionately smaller wire to fit in the same space as that occupied by the old coil.

Where a self-excited dynamo of the shunt-wound type is to be redesigned to give a higher potential, say one having several times the value of the original machine, a special auxiliary winding may have to be designed for the armature which will supply the necessary field excitation current through a separate commutator, as shown at Fig. 2. The amount of field excitation current can always be determined by means of an ammeter connected in series with the field circuit when the dynamo is running, preferably making the necessary connections before starting up the machine. For small sized dynamos, the field current will average between 5% and 10% of the total current output. A very good reference work to consult on all such factors as this is "Dynamo Electric Machines," by Wiener.

Referring to Fig. 1 for the moment, we see how an armature may be rewound for two or three times the original voltage by winding on it the same number of coils, but designing these coils to have the proportional greater number of turns necessary for the new voltage desired, arranging a tap lead at the center of the coil, etc.

There are two ways of solving the commutator problem in rewinding for high voltage; one of them is to purchase a new commutator with a greater number of segments than originally; and the other is to take apart the old commutator and by means of a circular saw placed in a lathe or milling machine, or else simply by using an ordinary hack-saw with one or two blades in it, the segments are cut in two or three parts, depending upon the ratio of increased voltage. Some pure mica strips are obtained and by laying one of the copper segments on the mica and marking around with a sharp scriber, the new mica insulation required is cut out with a pair of scissors or otherwise.

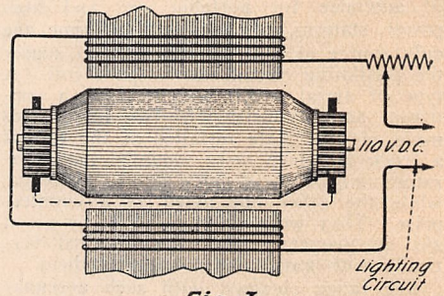


Fig. 3

If the Dynamo Has a Separately Excited Field, as Shown Here, It is Easier to Rewind it for a Higher Voltage.

The diagram at Fig. 1 shows the starting, center and finishing leads, Nos. 3, 2, and 1, respectively, and the method of connecting these to the commutator segments is also shown. The center or loop lead should be marked by tying a piece of string around it or otherwise. Anyone who has ever rewound a fan motor or other small D.C. armature, will understand how to wind the coils for higher voltage and how to mark and watch the connections to the commutator. The sequence of the leads must be watched carefully so that one or more coils are not reversed; this will usually be obviated by simply following the scheme of connecting the finishing and starting leads of adjacent coils together, and then noting carefully that these leads are not transposed when they are soldered to the commutator lugs.

Reference to Fig. 4-A, gives a clear idea of the winding on a 12 slot armature core and how the coils are overlapped at the ends. The first coil is wound in slots 1 and 7, the second coil in slots 2 and 8, etc. Note that coil 7 is wound in slots 7 and 1, so that the half of coil 7 comes on top of the half of coil 1, and fills the slot completely. Finally when all twelve coils have been wound on the armature, all of the slots will

Dynamos having a field winding on the armature may be rewound for higher voltage, but great care should be taken in the insulation between the high tension and field windings mounted in the same slots.

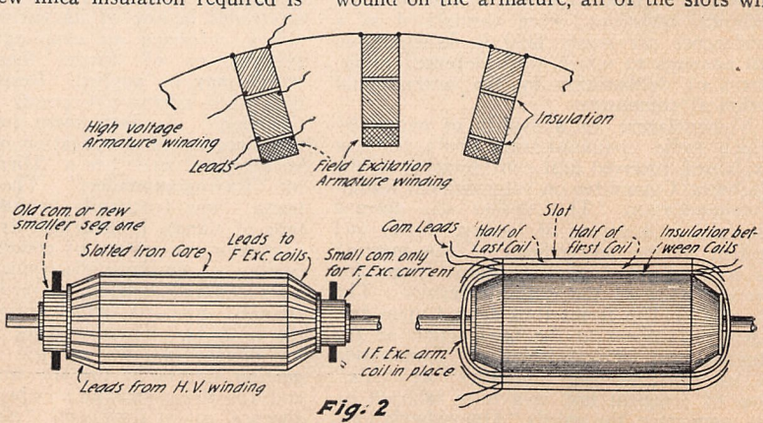


Fig. 2

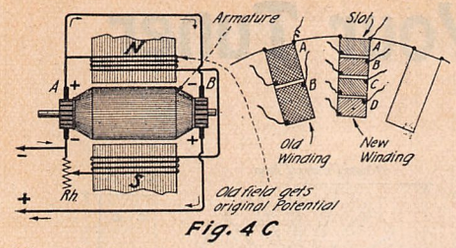


Fig. 4C

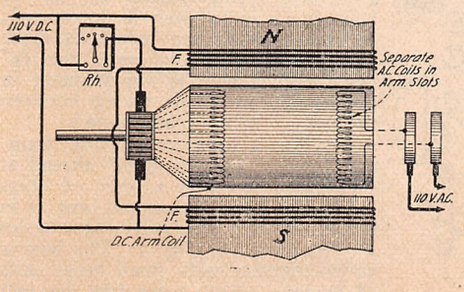
If a Double Commutator Dynamo Delivering 110V. May be Obtained, it is a Simple Matter to Make it Deliver 220V. by Connecting the Brushes as in This Drawing, and Using for the Armature Some Wire Having Just Half the Cross Section of that Formerly Used.

be completely filled. The method of bringing out the leads from each coil is clearly shown in the winding diagram at Fig. 4-A, and the final or twelfth lead is formed by joining the starting and finishing leads of coils one and twelve together. Care must be taken before stripping the old armature winding off to see how much *throw* the leads have with respect to the commutator segments. Referring to Fig. 4-B, it will be seen that where the brushes on the machine are placed on the neutral position between the field poles, the armature coil leads are brought straight over to the commutator segments. Where the brushes are placed on the same axial line with the field poles, however, the armature coil leads are given a *throw* or pitch either to left or right, which usually amounts to about 90 degrees, before they join the commuator segments. This difference, therefore, should be very carefully checked up and recorded before cutting the old leads and coils from the armature core.

In Fig. 4-C we see how a dynamo arranged with two commutators and two separate windings on the armature may be operated with the old field winding if the potential difference of the redesigned machine is but twice that of the original. Suppose, for example, that one has a 110 volt dynamo and wishes to redesign it to have two 110 volt armature windings and two commutators, the two armature windings being connected in series by means of the brush connections, as shown, to yield 220 volts D. C. Here the field windings and rheostat are simply connected across either one of the commutators, so as to receive 110 volts. In designing an armature winding such as this, each winding will of course supply one-half the total current produced. If the armature produced originally 110 volts, let us say, and two amperes; and if a single winding with a greater number of turns was used to give 220 volts, then the wire for the new coils would be selected to have one-half the circular mils cross-section, suitable to stand a current of one ampere; but if two windings are used, then the number of turns in each coil will remain the same as for 110 volts, but the cross-section of each wire in C.M. would be reduced to one-half the original value, or suitable to stand a current of one ampere.

In other words, the point to always keep in mind is that the watts, the product of the volts multiplied by the amperes, will always remain the same. In the case just cited, we have first 110 x 2 or 220 watts; with two separate windings rated at 110 volts and one ampere, we have for the wattage output of the armatures, (2) x 110 x 1, or 220 watts.

The sectional view through two slots, shown at Fig. 4-C, shows how the two coils, when doubling the voltage only, are placed in a slot which formerly contained but one coil of a lesser number of turns of heavier wire.



This is a Dynamotor That is a Combined Dynamo and Motor in One Unit. It May be Supplied With D.C. and Deliver A.C. at Any Voltage.

PLACING SEPARATE FIELD EXCITATION WINDINGS ON ARMATURE

Possibly the simplest way to arrange or to operate a high voltage dynamo is to have the field excited from a separate source of current, as shown in Fig. 3. Where commercial D.C. service is not available, the field winding may be redesigned with heavier wire so as to be suited for excitation from batteries. Where either of these schemes are not available and the field winding is to be excited from the armature of the machine, then several different ideas may be followed. Fig. 5 shows a high voltage D.C. dynamo arranged with four separate windings, each winding having its own commutator. Suppose, for example, that each winding and commutator delivers 220 volts or that the four armature circuits when connected in series, as shown, yield 880 volts D.C.; then the field winding may be connected across one of the commutators with its rheostat, which will supply it with 220 volts. This is assuming, for instance, that a 220 volt dynamo has been redesigned to give 880 volts.

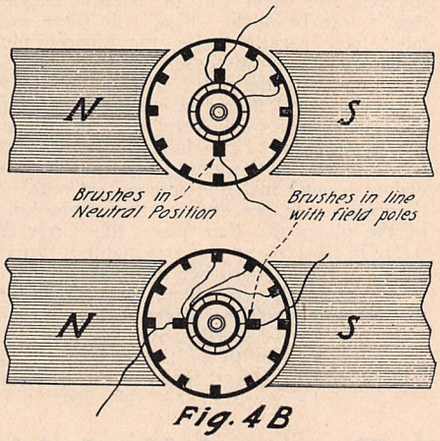


Fig. 4B

When the Brushes of the Machine are Parallel With the Field, the Leads From the the Coils Should be Thrown, as in This Diagram.

Referring to Fig. 6, we see how two or more D.C. dynamos are often connected in series to attain a proportionately higher voltage equivalent to E x N; E being the voltage of one machine, and N the number of machines connected in series. Where the resultant voltage is to be kept fairly constant, special driving arrangements will have to be provided to keep the speed of each machine very constant. Four 500 volt dynamos were thus connected in series to give 2,000 volts D.C. for testing dielectrics in one of the laboratories operated by the Western Electric Company. The field windings under such a condition as this, may be excited from an external source of current, as shown at Fig. 6, or each field winding may be excited from its own armature. The several dynamos to be connected in series may be driven by a chain or gear drive in order to keep the speed as constant as possible.

Coming back once more to a single high voltage D.C. dynamo, which may have its armature winding arranged in one of the several different ways already suggested, we see in the diagram at Fig. 2 how the small special winding for supplying the field excitation current is placed on the armature core. This winding is connected of course to its own commutator, as shown in Fig. 2 also. The method of designing this

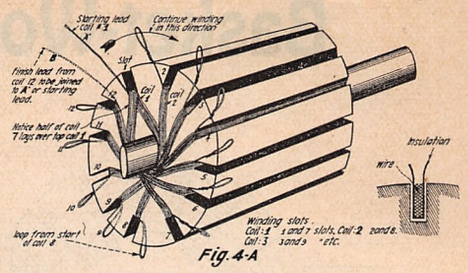


Fig. 4-A

This Sketch Illustrates the Method of Winding a 12-Slot Armature and How the Coils are Overlapped.

winding is as follows: Suppose we have a 110 volt dynamo giving 2.5 amperes; we will ignore for the moment the fact that we are going to redesign the armature to have a high voltage winding or windings on it, and simply confine ourselves to the problem of field excitation. Suppose that by measurement with an ammeter or by calculation, we have ascertained that the coils on this particular dynamo require 5% of the total current or about .12 ampere. The usual allowance in designing field and armature windings for motors or dynamos is 1,000 C.M. per ampere for stationary or field coils, and 600 C.M. per ampere for armature or other similarly ventilated coils. Therefore, the field excitation winding on the armature in this case should be designed so that each coil will have the same number of turns as originally, and the wire should have a cross-sectional area of .12 x 600 C.M., or 72 C.M. Care should be taken to place extra insulation between the coils constituting the low and high voltage windings, as well as between and around the coils composing the high voltage winding. Shellac may be used for low and medium voltages as an extra insulation, but some good armature varnish such as Armalac had best be employed, and the armature baked in an oven so that the insulating liquid will thoroughly permeate the winding. The machine should not be operated until the insulating varnish is thoroughly cold and set, as otherwise breakdowns are liable to happen in the winding.

DYNAMOTORS

So far we have considered dynamos to be driven either by a belt or otherwise from a motor or engine, but there is another form of high voltage machine known as the *dynamotor*. Fig. 7 shows the schematic circuits of a dynamotor. The dynamotor, as its name implies, comprises a dynamo and motor in one machine; usually a single field is used and the armature core is designed to contain two windings. The secondary armature winding may supply a higher or lower voltage than that supplied by the circuit from which the motor side of the machine is operated, or in some cases particularly where 110 volts A.C. is desired from the D.C. service mains, the auxiliary armature winding, as shown at Fig. 7, is connected to two slip rings and the A.C. is led off from these, by means of brushes in the usual manner. Carbon brushes should invariably be used on all high voltage commutators, owing to the fact that they offer

(*Continued on page* 408)

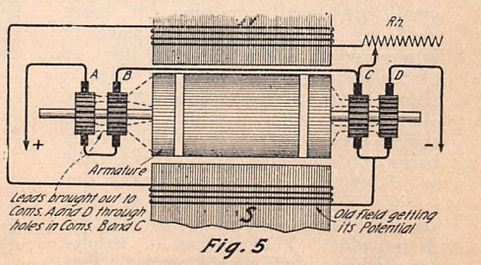
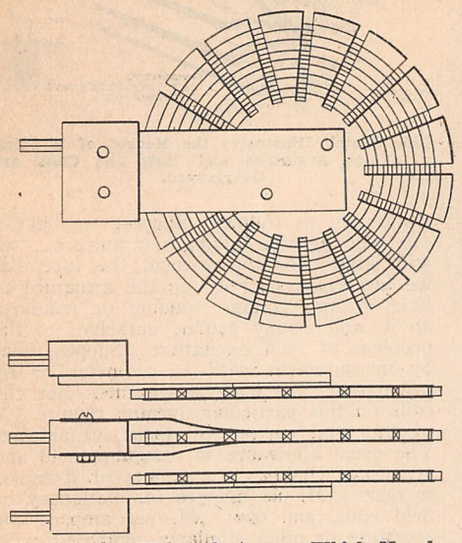


Fig. 5

For High Voltages Separate Windings Connected to Separate Commutators Are Best, as This Cuts Down the Tension in Each of the Windings of This Four-in-one Dynamo.

Basket-Wound Coils for Your Tuner

By PAUL G. WATSON



These Spider Web Inductances, Which May be Easily Constructed, can be Plugged Instead of Honeycomb Coils in a Standard Three Coil Mounting.

HAVING experimented for the past year on the best type of coil, for 200 to 450 meter work, to use in the receiving tuner described in the May, 1921, issue of RADIO NEWS, and having tried honeycomb, plain wound, bank wound and other types of winding, I found the following type coil to be most efficient for short-wave work.

The most important details are brought out by the drawings.

The winding form was cut from $\frac{1}{16}$" black bakelite. To cut the 17 slots for winding, careful work is necessary, and the piece should be placed between two small boards, the edges of each placed parallel, and about $\frac{1}{16}$" back from the line to which the cut is to be made. When placed in this manner, the whole thing should be clamped in a vise. A $\frac{1}{8}$" drilled hole should form the bottom of each slot, and the cutting should be done with a fine hack-saw.

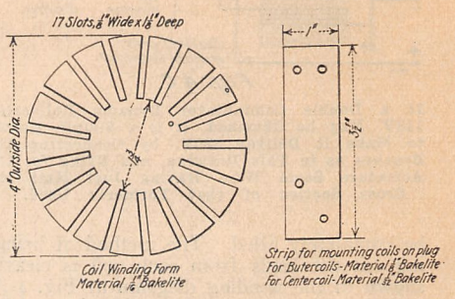
After cutting down each slot, the actual winding is the next step. The placing of the wire is very simple, ordinary basket weave, back of one section and in front of the next. About 25 to 30 turns on each coil will be sufficient wire, but in case this gives too great a wave-length, several turns can be removed from each coil. Number 24 D.C.C. was used in the original, and well shellacked, after winding. To fasten the wire ends, it should be passed through the small holes in the form, and then led to the plug terminals, when ready to mount.

The actual method of mounting is not important, but the method shown here has given complete satisfaction for some time and is recommended as being O.K.

The actual plugs for fitting in honeycomb mountings are available at low prices, so that this item can be bought cheaper than it can be made. Plugs for these coils must have parallel sides, the tapered plug being useless in this case.

In mounting the outer coils, a right- and a left-hand coil should be made, the reasons for which can be clearly seen in the assembly drawing. The bakelite strip should be fastened to the plug by two flat head (countersunk) machine screws and nuts. It is much better, however, to thread the holes in the plugs and then place the screw directly in the plug; many are unable to thread bakelite, hence the other method.

To fasten the coil form and winding to the strip, it should be placed so a $\frac{1}{16}$" space is between the coil edge and the plug end. A spacer, the width of the strip and 1¼" long should be placed between the coil center and the strip to allow space for the winding. It will be noticed in the assembly drawing that the coupling is loose between the coils. If tighter coupling is desired, thicker spacers should be used, placing the outer coils nearer to the center one. The coupling shown in the drawings was satisfactory in the original set of coils. The coil form is fastened to the bakelite strip and spacer by means of two soft copper rivets which should be countersunk on both sides.



Here is Given the Size of the Form on Which the Wire is Wound with the Dimension of the Bracket Supporting the Coil in the Mounting.

The middle coil mounting is considerably different from either of the outer coils; it is mounted by two strips of celluloid 1" wide and 3½" wide, respectively, the coil ends being riveted under washers and the plug end being fastened with a round head machine bolt and washers. If suitable fiber is available, it will do, but the celluloid is obtainable in any automobile supply store.

Coils mounted in this manner worked fine in the honeycomb coil tuner, but in connecting the ends of the windings to the plugs, it will be found necessary, in some cases, to reverse the wires to get maximum

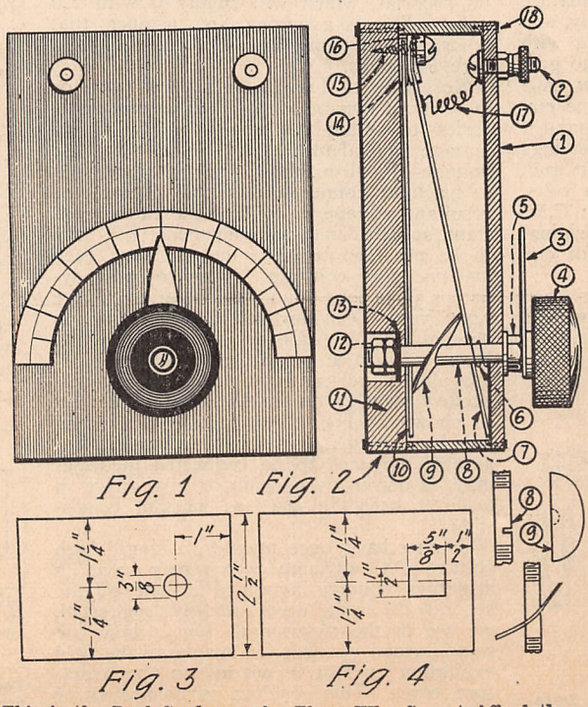
(Continued on page 457)

A Simplified Type of Variable Condenser

By ROBERT I. TORAN

HERE is a novel type of variable condenser made by me. I do not think one like it was ever made before. The one I have made and am using works far better than the old rotary type in every way. It is more convenient, sensitive and capable of finer adjustments. It can be built by the amateurs at almost no cost and it is just the thing for those with thin pocketbooks.

Fig. 1 shows the top view of the variable condenser when finished. Fig. 2 illustrates the internal construction of the condenser. It consists essentially of two plates, 7 and 11. Plate 11 is 3¾" x 2½" x $\frac{1}{16}$" thick and it is fixed to the base with small brass nails or pins cut about $\frac{5}{16}$" long. The surface of plate 11 is covered by a thin piece of mica 10 of the same size as the plate. Fig. 3 shows how plate 11 and mica 10 should be cut and drilled. Fig. 4 shows how plate 7 is cut, its sizes being the same as plate 11, except the sole is square and no nail holes drilled in it. Note that the piece of mica 10 should have no nail holes. Plate 7 is movable. Four pieces of empire (varnished) cloth 14 are needed. Two of these pieces are ⅝" wide by 2½" long and are glued to plate 7, as shown in Fig. 2. The other two



This is the Real Condenser for Those Who Cannot Afford the Expensive Models of "Variables."

pieces are $\frac{5}{16}$" wide by 2½" long, and are placed under the other pieces. No. 16 is a piece of fiber, hard rubber or wood ¼" wide, ⅛" thick and 2½" long; two holes are drilled, one at each end, for two brass wood screws 15, to hold plate 7 to the base allowing it to move like a book cover.

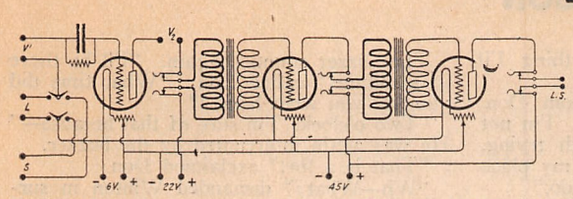
No. 1 is the box which is made out of a cigar box or some other hard wood, with a bottom ⅜" thick. A hole is drilled, as shown under the base, for a washer 13 and two lock nuts 12, to hold rod 8 in place. (Note: a hole $\frac{3}{16}$" in diameter should be drilled through and a hole ½" in diameter about ¼" deep.) No. 6 is a tension spring placed on top of plate 7 so as to push it downward; 19 is the spring seat which is made of brass ¾" long, ⅜" wide and $\frac{1}{16}$" thick, with a hole ¼" in diameter in the center, and it is placed between the tension spring 6 and plate 7.

No. 8 is a brass rod $\frac{3}{16}$" in diameter by 1½" long with ½" thread at each end. No. 9 is a piece of brass cut in the shape shown and bent as in bottom sketch; after inserting it in slot 20, cut in rod 8, Fig. 5. The box is nailed together with small brass nails 18 or pins. Nos. 2 are two dry cell binding posts; 17 is a piece of flexible

(Continued on page 457)

A Detector and Two-stage Amplifier for $27

By R. H. CARD



In This Detector and Amplifier is Incorporated an Anti-Capacity Switch, to Change From One Circuit to Another.

HERE is a detector and two-stage audio frequency amplifier, which is well suited for the amateur, as almost any hook-up can be used without removing the panel from the cabinet and digging out the solder.

While it was designed for use with variometers and a variocoupler for short waves and honeycomb coils for long waves, you may use your old loose coupler for the press and time and a variocoupler and variometers for the C.W. and phone stations. As you probably know, new apparatus is being produced continually and the amateur is very fortunate if his old instruments can be combined with the new. With this panel any inductance or combination can be used without changing the wiring in the rear of the panel.

For the short-wave set, the grid and plate variometers are placed upon the top of the cabinet and connected to the binding posts which are mounted along the upper side of the panel and the variocoupler is connected to one pair of the posts at the left side of the panel. The long-wave set is connected to the other pair of posts and the anti-capacity key switch is used to change from long to short waves, a double pole, double throw switch being used to change the primary of the set.

The filament lighting battery is connected to the posts at the lower edge of the panel. The 22½-volt "B" battery for the detector is connected to the second pair of posts and the amplifier "B" battery is connected to the third pair at the lower edge of the panel. The pair of binding posts at the right end of the panel are for a loud talker or for added stages of amplification.

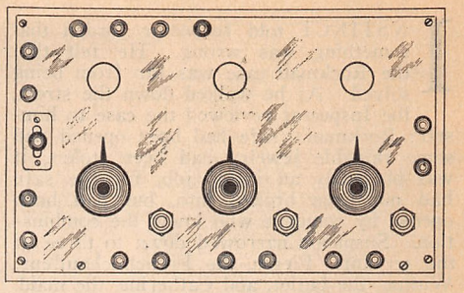
This instrument is within the financial reach of most amateurs, and any fellow with a fair knowledge of tools can assemble it in a short time. A complete list of parts and materials follows and I would advise the builder to use the parts listed, as they have been selected because of their compactness, performance and price.

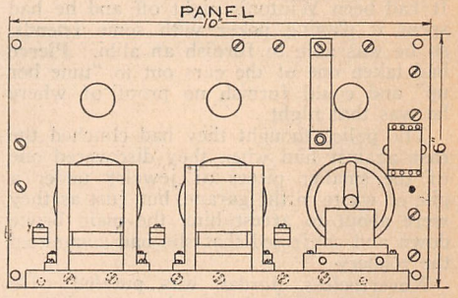
1	Formica panel, 6" x 10" x 3/16"	$1.25
1	White wood board 3' x 6" x ¼"	1.00
3	Murdock sockets	3.00
3	Remler Jr. rheostats	3.00
3	Federal telephone jacks @ $.85	2.55
2	Acme amplifying transformers A-2	10.00
1	DeForest anti-capacity key switch.	3.00
16	Rasco binding posts No. 202 @ $.08	1.28
1	Grid condenser and leak	.50
	Wire, drills, screws, etc	1.42
	Total	$27.00

I think that the drawings can easily be followed, but I will say that if you have never drilled formica before I think it would be a good plan to cut a piece of wood the exact size of the panel, mark off the holes on it, clamp it to the panel with wood clamps and drill through the wood, as you have indicated. This method prevents the drill from slipping and the holes will be exactly where you want them. Before drilling, the panel should be given a dull grain finish by sandpapering it with a very fine paper and then rubbing it with oil. The holes for securing the panel in the cabinet were drilled with a ⅛" drill and countersunk to take half-round N.P screws. The three holes which made the filaments visible are ¾" in diameter.

The cabinet is made of white wood, which is very inexpensive, easy to work and neat in appearance. It is 10" by 6" by 5" deep (inside). The main point in constructing the cabinet is to have the corners snug and to have the panel fit tightly. At each corner a small piece of wood should be fastened inside to prevent the panel from slipping back and to furnish a means of securing the panel in the cabinet.

The base is fastened to the panel with two ¾" half-round N.P. screws and is of the same stock as the cabinet. It is 8¼" by 4¾". In order that the base may fit close to the panel, you will have to make a small cut for each of the six binding





Front and Back Views of the Complete Apparatus. Note the Binding Posts for the Variometers, Which Are Thus in Circuit With Either of the Sets Connected.

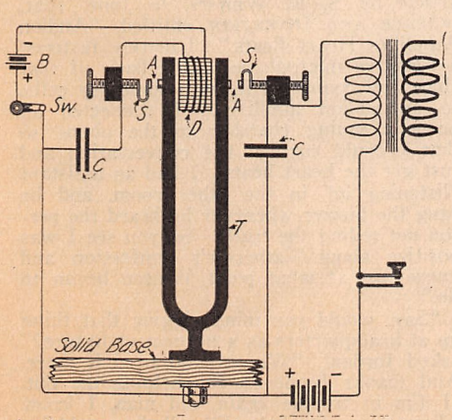
posts at the lower edge of the panel. Do not make the cuts larger than ⅜" by ¼", as this size will give plenty of room for the screw heads and wire.

As may be seen by the drawings, the tube sockets and amplifying transformers are mounted on the base and the complete unit is set into the cabinet and held there by four screws. The binding posts are placed 1" part, the rheostats and filament windows are spaced 3" apart.

All wiring should be done with No. 14 bare copper wire and all joints soldered. When connecting the jacks, be very careful not to let any solder drop on the delicate springs, as this will short circuit the whole set and cause much trouble. The bus bar method of wiring should be followed as much as possible, as a great deal of howling and other faults are eliminated by proper wiring of the panel.

An Improved Spark Coil Interrupter

By L. R. C. McATEER



A-silver or tungsten contacts B-buzzer battery C-5 M.F.D. telephone condensers D-electro magnet E-spring contacts T-tuning fork

With This Interrupter Very High Pitched Pure Notes May be Obtained From a Spark Coil Transmitter.

HAVING tried several types of spark coil interrupters, and having been unable to obtain the pitch desired, I designed the interrupter here shown, which, once adjusted, gave a clear and constant note.

As may be seen in the diagram, it consists of a tuning fork, between the branches of which is mounted a small electromagnet attracting one branch, which, acting as buzzer vibrator, makes the fork vibrate with its own frequency.

On the other branch of the tuning fork is mounted a contact with a screw which is used as an interrupter in the primary circuit of the spark coil.

The hook-up, which is simple, shows clearly all the connections and the mounting of the electromagnet between the branches.

In order to adjust the contact very closely, it was found necessary to mount the silver or tungsten contacts on the little spring blade, as shown in the sketch.

To run the buzzer, a small cell only is necessary, but a dry battery will do.

In the circuit of the primary of the spark coil is inserted the battery supplying the power and the key. A small switch in the buzzer circuit is used to cut out the circuit when not in use, as the buzzer runs constantly, even if the key is not pressed. Across the contacts are mounted two condensers C, of 5 mfd., as used in telephone circuits.

The electromagnet mounted between the branches of the tuning fork consists of an iron core made of a bundle of fine wire about 1" in diameter, wrapped with paper, over which are wound two layers of No. 26 or No. 28 S.C.C. magnet wire.

The tuning fork may be of almost any desired pitch, although I have not tried any higher than 435. For small spark coils, this interrupter used in conjunction with a quenched gap in the secondary, gave good results as to range and note.

Spark coils without interrupter may be obtained cheaply and a portable sending set made that will work a good range easily.

The Wireless Third Degree

By GEORGE A. GIBSON

INSTINCT told Inspector Jordan that something was wrong. He felt that the Rockman case was far from being solved. As he walked down the street, the Inspector reviewed the case to himself: Rockman's safe had been opened and some valuable jewelry had been stolen; it was obviously an inside job, for the safe had not been broken into, but had been opened by someone who knew the combination. Suspicion narrowed down to three of the servants, Pierre, the French chauffeur, Winton, the butler, and Catherine, the maid. It had been Winton's night off and he had spent it playing poker with some friends, so he was able to furnish an alibi. Pierre had taken one of the cars out to "tune her up" and could furnish no proof of where he was that night.

The police thought they had clinched the case against him when they discovered one of the smaller pieces of jewelry under a pile of waste in the garage, but, just as they were about to arrest him, the maid broke down and confessed that she had committed the robbery.

Nevertheless, Jordan was puzzled. He first thought that the maid was trying to shield Pierre; they were engaged and it was quite natural that she should try to protect her lover, but Pierre was a decent sort of a chap and Jordan knew he would not let Catherine sacrifice herself for him. The Inspector felt sure he would have admitted his guilt rather than have her arrested.

Still worrying over the case, Jordan came to the house of his friend, Donald Spencer. Don had worked in the Intelligence Department with Jordan during the war and a great friendship had grown between them. Now that Jordan had joined the police force and Don had gone back to his work as electrical engineer, they seldom saw each other. So this evening the Inspector decided to take a little vacation and visit his old friend.

As Jordan entered the "lab," he was greeted by strains of music from a loud speaker in one corner of the room, and a series of grunts from his old friend who, with a rubber tube in his mouth, was trying to manipulate a small pocket blow torch, a strip of solder and a half dozen loose ends of wire at the same time. Jordan seated himself on a corner of the work-bench and waited for his friend to get through.

"Gee, but I'm glad to see you, 'Jord.,' old man," said Don as he blew out the torch and tossed it under the table. "Anything special going on, or is this just a friendly visit?"

"Just a friendly visit, Don," said the Inspector. "Thought I'd quit the job for one night and relax; don't want to go sour, you know."

"I see. Then there is something worrying you," replied Don. "Take a chair, or rather, take *the* chair and tell us your troubles."

He handed Jordan a cigar and, lighting his pipe, perched himself on the edge of the work-bench. The Inspector told him all about the Rockman case and his doubts concerning the maid's confession.

"That should not be so hard to solve," said Don. "Will you let me help you?"

"Sure thing," replied Jordan, "but I don't think it will be much use. That confession makes the three stories fit together so neatly that I don't know where to 'break through the crust.'"

"Well, forget it now, old man," Don answered, "and if I think of anything I'll phone you."

Next morning a call came from Don. "Jord., old man, I've got an idea. I'm not sure it will work, but it is worth trying. If you'll bring those people up to my place this afternoon, I'll se what I can do."

When Jordan and his charges arrived, they were shown into the parlor, much to the surprise of the Inspector who expected Don to see them in his "lab." Jordan had great faith in his pal's mechanical ability and anticipated seeing some weird and complicated apparatus that Don might devise for investigating the case. Donald, who was standing in the middle of the room, asked them to seat themselves in the chairs which he had placed at one side. He first asked Pierre to seat himself in a small chair at the opposite end of the room and tell his story. The chauffeur did not have much to say. Early in the evening he had asked if he would be needed that night, and when he was told he would not be, he had taken one of the cars out on the road to make some adjustments. He had had some trouble with the engine and so did not get home until after three o'clock. He then learned that the safe had been found open at one o'clock and the jewels were missing. Don dismissed him without any questioning.

"What Time Did You Say You Went Home?" "Two O'clock, I am Sure of That Because . . . "That is a Lie!" exclaimed Don.

He next called Catherine, who seated herself, nervous and trembling on the edge of the chair.

"Now," said Don, "don't get excited, I'm not going to bite you. Sit back and make yourself comfortable, and then tell me your story."

"I did it," cried Catherine. "Everyone was out and I knew the combination from watching Madame open the safe. It was such a good opportunity I could not resist it."

A slight buzzing noise was heard but Don did not pay any attention to it.

A smile of satisfaction appeared on Don's countenance. "That will do, Catherine," he said. "I guess the case is completed now. While you are here, Winton, you might tell me your story, if you don't mind, so that I have all the facts."

"No trouble at all, sir," said Winton, as he seated himself. "You see, sir, it was my night out so I went to Lord's garage, where some of the boys and myself started a little game of poker. The game got so interesting that it was two o'clock before I knew it. Then I went right home, sir."

The buzzer sounded again. "I'll be there in a minute," called Don. "What time did you say you went home?"

"Two o'clock. I'm sure of that because—" He was again interrupted by the buzzer.

"That is a lie!" exclaimed Don.

"Wh—What?" demanded Winton in surprise. "Why, sir, I can get the other four men to swear that I left at that time."

"I don't care if you can get a million men to swear to it. It's a lie because I know you left before two. I also know that Pierre is telling the truth, but that Catherine's confession is untrue. She believed that Pierre did it and was trying to shield him."

The looks of astonishment on the faces of the Inspector, Pierre and Catherine cannot be described. As for Winton, he broke down completely.

"If you know all that, sir, I may as well confess. I took the stuff and tried to put the blame on Pierre, but what gets me, sir, is how you knew when I left. I thought no one had seen me go back to the house."

"Never mind the rest," said Jordan, coming to his senses. "You can tell that to the Judge."

That night Inspector Jordan visited Don's "lab." again, but with a different motive in mind. "Don, old timer," he said, "how did you do it? You contradicted Winton so firmly that I felt sure you must have some evidence."

"I did," said Don as he busied himself with a coil he was winding.

"Will you please tell me how you did it" asked the Inspector, "you sure have me stumped."

"Do you mean to say you didn't get on to what I was doing?" exclaimed Don, stopping his work and turning to the Inspector. "It was very simple. It is a well-known scientific fact that it takes more energy to tell a lie than it does to tell the truth. A noted eye specialist in New York says there is a slight movement of the retina of the eye noticeable when a person makes a false statement. You probably have read that, by using an instrument which records the pulse, it is possible to distinguish true statements from false ones. There is a noticeable change in the beating of the heart. Keeping that in mind, I looked through some old magazines and found an article by S. R. Winters, in June, 1921, SCIENCE AND INVENTION entitled, "Audion Amplifies Heart Beats." I merely fastened a sensitive microphone to the back of that chair and connected it, with some dry cells, to an audion amplifier. I connected an acoustic tuning chamber to the phone so that I could cut out the conversation and just get the heart beats. I had an assistant "listening in" in the other room, and he rang the buzzer whenever he heard the person not telling the truth. So you see I was positive about Catherine's confession and knew just at what point Winton began to lie."

"Say, would you mind rigging that thing up at headquarters as a permanent fixture?" asked Jordan. "We sure do need it there. And thanks *beaucoup* for helping me out. If I'm in trouble again, old man, I know where to go for help, I'll tell the world."

9IX

We are informed that this call is now that of Messrs. John D. West and Alvin N. Dedricks, 1404 Michigan Ave., Manitowoc, Wis. Please take notice.

Inland Castaways

By Elliot Marner

"DOC" RILEY called me on the phone the other day. "Doc" is a genial chap, widely popular, but averse to telephones and telephoning. When he does use the instrument, therefore, his friends are certain that another novel stunt, social or otherwise, is about to be set afloat by the resourceful young medic.

"Hello," says Doc, "that you, Brownee?"

"Yeh," says I, "glad to hear your familiar accents. What's up?"

"It's like this," he says, coming straight to the point, "Jimmy Rudd and I, together with you-know-who, are planning an all day ramble in my car Saturday—down into the mountains, and we'd like to have another couple. Plenty of room, you know, and much pleasanter in the tonneau. How about it?"

"Suits me, Doc," I agreed, "but how about the roads—isn't this a little early in the year for a trip into Pennsylvania?"

"The roads are drying out, and the weather is becoming warmer every day; it's a stunt anyway. Things are inexpressibly dull nowadays. Be down early, will you? We expect to start about 7 A. M."

Saturday morning, a hop or two behind the birds, I appeared at Doc's house. Jimmy Rudd was already there helping Doc put the finishing touches on the car. The day promised to be fine and in high spirits we drove off to call for the lady members of the expedition.

Some time later, to be exact, shortly before noon, the merry party was bumping slowly over a lonely road well into the wilds of Porter County. The last town had been left 15 miles back and it was an hour since we had seen a dwelling of any kind; forest-covered hills loomed steeply on either side of the narrow trail; but for the sun which shone with all the brightness and warmth of a typical spring day, the aspect would have been rather gloomy.

"Good place for a murder," observed Doc cheerfully, "but say you folks, how about some lunch? Feel hungry?"

The chorus of assent was vociferous.

"All right," said Doc, "see that barren hill over on the right? Looks like a road winding up the side. Let's see if we can get there."

He stepped on the gas and we jolted fiercely for a time. Then a grassy lane, evidently unused for a considerable length of time, branched off from the road and we followed it. The car rolled easily.

One of the girls spied a building amidst a clump of trees on the very brow of the hill and for a moment there was a debate as to the proper procedure.

"They can't do more than kick us off," opinioned Jimmy Rudd, "let's go."

A few moments later we negotiated the last incline and Doc brought the car to a stop a short distance from the house. The lane led directly to it, but the place seemed untenanted.

"A deserted house!" exclaimed Jim, who was of an adventurous turn of mind, "let's explore!"

The feminine chorus approved shrilly, so we relieved the automobile of sundry lunch boxes, together with a sprinkling of vacuum bottles, and went gaily forth.

The house proved to be quite deserted and after partaking of a sumptuous repast, accompanied by the customary festivity attendant upon a picnic in the country, we proceeded to investigate.

The place contained the usual collection of trash common to abandoned dwellings. The only object of interest was a telephone, one of the old crank-on-the-side type, which hung on the kitchen wall. A couple of decrepit dry batteries that had long since outlived their usefulness lay amidst a heap of rubbish on the floor.

The telephone piqued our curiosity, and the lady explorers, in dainty succession, cranked vigorously. There was no reply to their efforts, however, so I made an attempt. The phone was as dead as the proverbial portal protuberance. We explored further.

The reason for the lifeless conduct of the phone was soon manifest. A pair of wires ran from the house to a barn some 200 feet distant, where they ended abruptly. A counterpart of the other instrument had at one time occupied a position in the feed-room, but now the twisted ends of wire gaped vacantly from the wall.

"No chance, girls," commented Doc dryly, "line's out of order—as usual."

It Was a Strange Scene, the Spark Flared and Flickered, Casting Grotesque Shadows Upon the Dilapidated Wall.

The afternoon passed all too quickly. The old farm contained innumerable sources of interest. The view from the hill was unsurpassed, and when lengthening shadows of early sunset caused Doc to hastily consult his watch, one and all declared it was too soon, but the wisdom of an early start for home was apparent. Summer had not yet put in an appearance and pleasant though a spring day may be, the evenings of the "violet season" are usually quite the contrary. We trooped reluctantly back to the car.

"Well, folks," I said, as we settled ourselves comfortably for the long ride, "we'll have to induce Doc to take us out here again. What say everybody?"

"Will we—well, I guess." "You bet."

For a few moments approving exclamations and bustling noises mingled, then Doc called back over his shoulder:

"Everybody happy? Bundle up well, you fellows, and don't let the girls freeze—it's going to be chilly before we get home—all ready?"

We shouted acquiescence.

"All right—here we go." He leaned over the wheel, buzzed the starter and then cut in the engine.

Nothing happened.

The starter buzzed again, but there was no response from the motor. Doc mumbled something under his breath and the starter buzzed for a long time. Then silence.

Doc climbed out.

"Must be a connection loose," he muttered. He opened the hood and went over the engine carefully. Everything appeared to be in order. The starter was operated again, but the engine refused to come to life.

Jim and I joined forces with Doc and took turns cranking by hand, but without result.

Meanwhile the sun had receded behind the farthermost hills, and down in the valley darkness was rapidly setting in. Remarks were unnecessary, and we assailed the crank handle with renewed vigor.

The engine declined to be coerced.

We meditated upon the situation, and suddenly to the three of us came the same dire suspicion. We tiptoed softly to the gasoline tank. It was empty!

"Jim!" exclaimed Doc, "you brought out the gas can this morning. Did you fill the tank?" But Jim's eyes already told the story.

"I never thought about that can until now," he groaned.

The predicament was certainly serious. Night was coming on, and with it a raw, cold wind that pierced to the skin. We were 40 miles from home. The last village on the road, at least 15 miles in the same direction, and human habitation there was none, to our knowledge, within less than an hour's slow ride.

The hill top commanded a wide view of the valley, and in the miles of forest which spread beneath our gaze not a light or curl of smoke gave evidence of other human presence than ourselves.

The girls were frightened; I confess to a lack of optimism myself. Jim assumed all the blame for the occurrence and insisted on walking to the town for assistance, but we refused to allow it.

Doc rummaged through the car, in the hope that a forgotten bottle of gasoline might be found, but to no purpose.

We were helplessly marooned on the hill.

"Take out the extra robes, girls, and keep as warm as you can," said Doc; "we will build a fire here, and then try to find a way out of this."

He smiled cheerfully, and set briskly about gathering wood, whereat we all took heart and did likewise.

The fire was soon crackling brightly and it provided a momentary comfort.

"Now," continued Doc, "suggestions as to ways and means of reaching Jamesburg are in order."

No one had anything to offer.

"Well, then," he went on, "the only thing to do, is for Jim and me to walk to town. Brown is the huskiest, so he will stay and protect the ladies—come on, Jim!" Then he added wryly, "If the phone in that house was only connected to a line instead of a pair of useless wires; but it is as I have always maintained, a telephone is a nuisance."

"If we only had a wireless!" exclaimed one of the girls.

"Useless wires—wireless!" The idea was

(*Continued on page* 444)

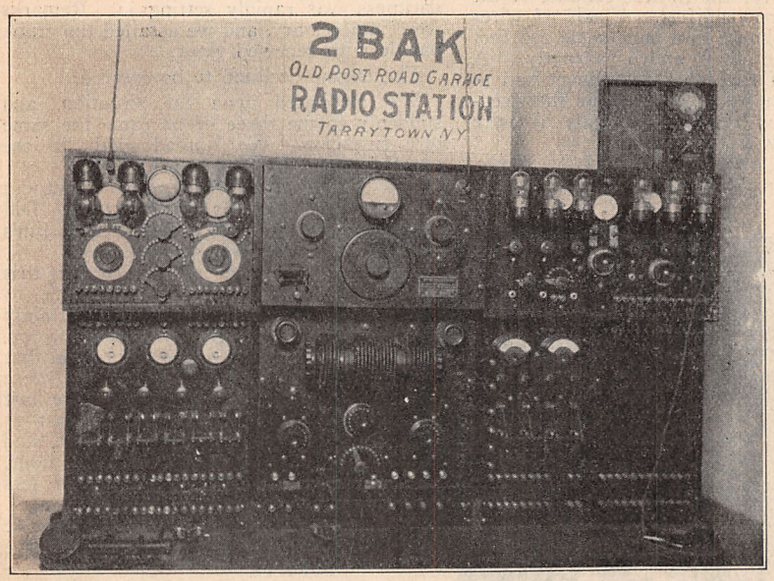
THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00 All other pictures published will be paid for at the rate of $2.00.

2 BAK Tarrytown, N. Y.

This Month's Prize Winner



Look at this one boys, it is a real complete station with a tube set, an arc transmitter, regenerative receiver with Radio and audio frequency amplifier, and note the wiring, too.

THIS station was conceived by Frederick Koenig, who became interested in Radio through his son last January, when he built a loose coupler from a description in the "Boy Scouts' Manual." Mr. Koenig saw wonderful possibilities in radio and has been experimenting with radio telephony and telegraphy.

The Old Post Road Garage is equipping its service car with a receiver and the garage can get in touch with same when it is out on the road. The transmitting sets and receiver, as well as all controls, are mounted in one cabinet and are all removable by bus bar wiring and are interconnected in a 2¼" space between the top of the table and the bottom of the cabinet. There are no exposed wires except the telegraph keys, microphone and head phones. Connections for high voltage, A.C. for heating transmitter filaments, "A" and "B" batteries are made to binding posts on back apron of the table. All these connections are marked so that at any time the set may be moved; handles are on each end of the cabinet and same may be lifted from the table. The left top panel contains the C.W. transmitter and the left lower the C.W. controls. The Heising Colpitt system with buzzer or voice modulated C.W. may be used. Throwing several switches the four tubes are used as oscillators for straight C.W. or I.C.W. using a chopper wheel. Note all the adjustments are variable. The inductance has variable taps for wavelength, plate and grid coupling.

The center panel contains what is known as a ¼ K.W. Low Power Motor Boat Radio Set built by the Sperry Gyroscope Company. It is of the D.C. Arc Type, with a modifying circuit to break up the sustaining waves into audible frequency groups.

The motor generator is a 600 volt, Croker Wheeler unit.

The lower panel to the right of the arc transmitter contains the volt meters and a double throw four pole switch for throwing the D.C. either to the arc or C.W. transmitter.

In the center panel below the spark gap is mounted a short-wave receiver.

(*Continued on page* 416)

3 AMY East Lansdowne, Pa.

BELOW is a concise description of this station. The antenna is a four-wire cage type 50 ft. in length and 60 ft. high with cage lead in.

The water pipe system is used as a ground.

The receiver is a one step using tickler circuit with DeForest honeycomb coils of all sizes, giving a wave range up to 25,000 meters. Below this is a primary condenser switch and Chelsea condensers. A spider-web can also be plugged in for use on short wave-lengths. They give sharper tuning. A crystal detector is also mounted on the side.

The transmitting set consists of a spark coil set and a 5 watt C.W.

This C.W. set works very QSA and I think makes a very complete set at a moderate cost. The Hartley circuit with Heising modulation is used. Two radiotron 5-watt tubes are used, one as oscillator and one as modulator. The plate current is derived from a motor generator consisting of a ¼ H.P. motor driving a 220 v. direct

(*Continued on page* 412)

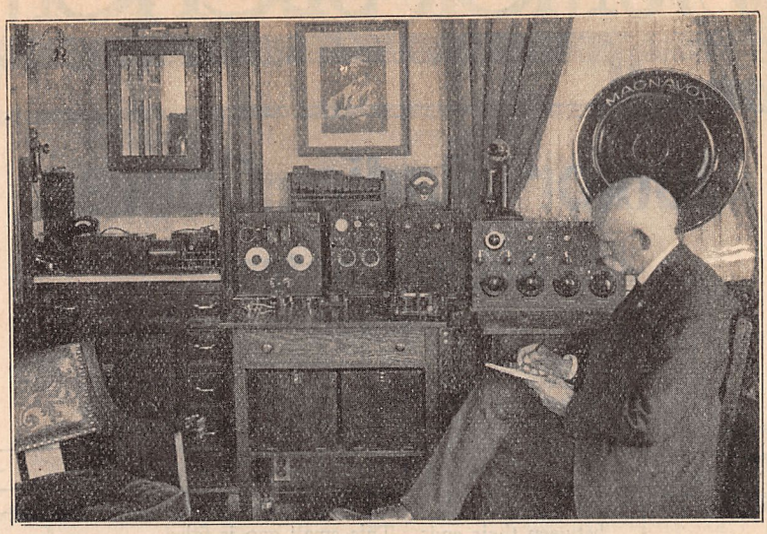
This station is home made and yet up to date. The builder is shown in the corner talking into the microphone.

J. Brodie Smith's Station

At Manchester, N. H.

THE photograph is that of Mr. J. Brodie Smith's station, which is only a receiving one. It is equipped with a honeycomb coil tuner for long waves and with a regenerative receiver of late design for short waves, the latter being equipped with a detector and two-stage amplifier and may be seen under the Magnavox. In conjunction with a long-wave tuner, a DeForest detector and one-stage amplifier is used with a two-stage amplifier attached to it.

As may be seen in the photograph, this forms a very complete station of good appearance and of high efficiency. On the left of the photograph, in the closet, may be seen the little loose coupler, which was Mr. Smith's first set. The antenna, which consists of four wires, is erected between the house and a pole about 60' high.



Mr. Smith is an Old-Timer, But Has a Fine Receiving Station Equipped With Up-to-date Apparatus.

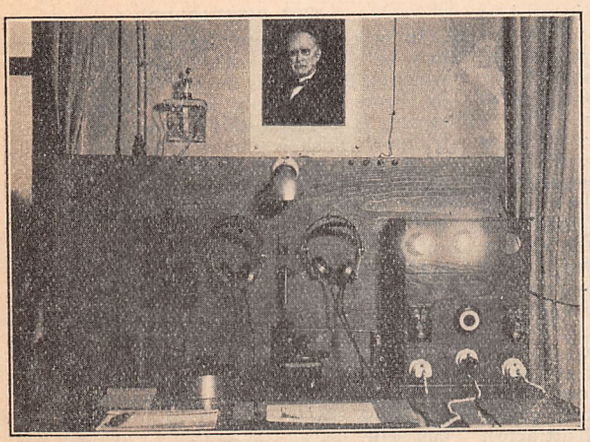
Thanks to the Magnavox, Mr. Smith can entertain his friends with Radio music quite often, and the voice from the Santa Catalina Island Radio Station comes in quite clear and strong as well as the answers from the ships on the Atlantic, when experiments are carried on, also the music sent by amateur stations and the transmission of very distant stations.

Very often, while Radio music is coming in, Mr. Smith entertains his friends in their homes by calling them on the phone, which may be seen on the top of the short-wave receiver, and placing it in front of the Magnavox.

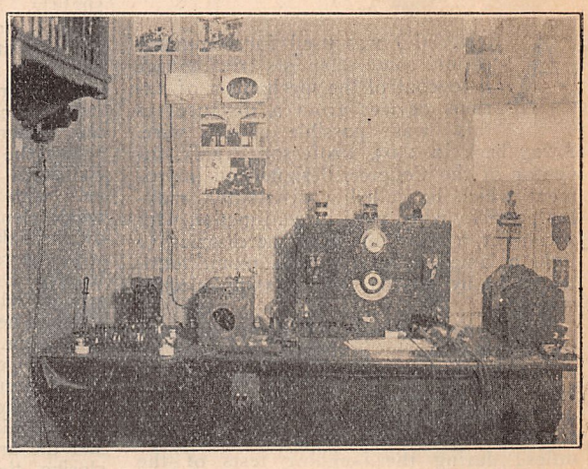
The music retransmitted this way is sometimes so loud that several persons may hear it at the receiving end of the line and enjoy a Radio concert, as much as the owner of the set does.

European Amateur Stations

The Radio Club of Luxembourg



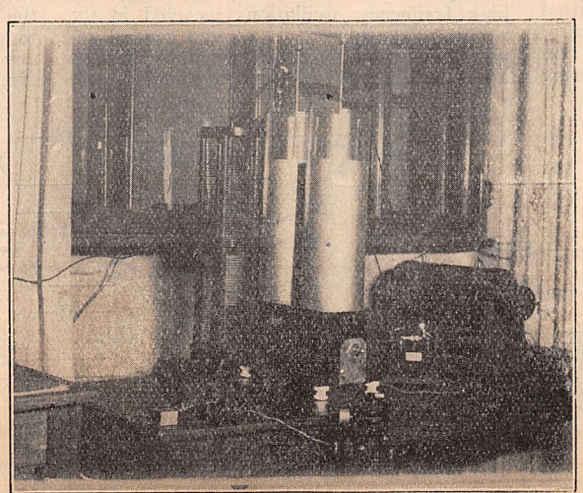
These twop stations, belonging to members of the Radio Club of Luxembourg, are entirely home-made and equipped with V.T. detector and amplifier. In the one on the left may be seen an amplifier of clever design, which by means of a switch, may be changed from two-stage radio frequency and detector into detector and two-stage audio frequency amplifier. On the top of the cabinet on the right, may be seen two German and one French tube.



TO give an idea to our American amateur friends of what is going on in this part of Europe, we send the accompanying photographs showing two amateur stations in Luxembourg and the sending apparatus of the Laboratory of the School of Industry. The first station on the left belongs to Mr. G. Gillen, who is vice-president of the Radio Club of our town. and was one of the first to become interested in Radio in this country.

The station is equipped with a loose coupler, with the necessary tuning condensers and a home made amplifier, which, by means of a switch, may be used either as a two-stage radio frequency amplifier and detector, or as a detector and two-stage audio-frequency one. The sending set consists of a big spark coil and tuning circuit and gives a radiation of about one ampere in the aerial.

The other receiving station, which is shown in the photograph on the right, belongs to Mr. P. Muller, who has the call letters PM. This station is also entirely home made, and equipped with an amplifier in which German and French tubes are used; it gives good results to its owner, who can receive American stations and others quite clearly.



Here is the Experimental High-Frequency Oudin Coil Built by the Members of the Club. The Same Spark Coil and Condenser Are Used for Transmitting in Connection With an O.T. Note the Mercury Interrupter in the Foreground.

The sending set, remotely controlled, consists of a transformer supplied by 110 volts A.C., with condenser, rotary gap, O.T., etc., and has a range of about 50 miles.

The photograph in the center shows a high frequency Oudin coil made by the members of the Radio Club, and installed in the Laboratory at the School of Industry. This high frequency machine works with a spark coil and a rotary mercury interrupter. This same apparatus was used at the beginning as a sending set, but has since been improved and replaced by a transformer with a rotary gap and has a range of about 100 miles.

The aerial used at this station consists of two wires about 330' long, stretched between the tower of the church and a chimney of the school. On this antenna, with a good receiver, American stations are heard very plainly, as well as the Radio concert which is sent twice a week by the Dutch station PGGC, at Amsterdam, Holland, and other high-power stations of the world.

JEAN WOLFF, Sec'y of Luxembourg Radio Club.

Junior Radio Course

Radio Control

First Part

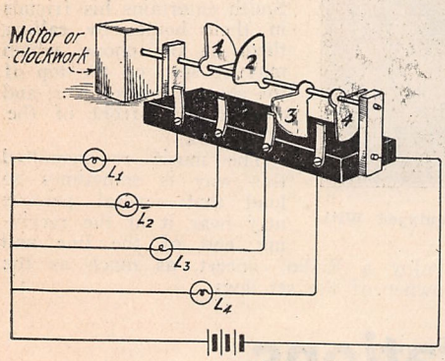


Fig. 2

Detail of the Distributor, Closing the Various Circuits One at a Time, Which is Used in the Radio Control Device Described in this Lesson.

AS RADIO was used for communication, some scientists tried to use it to control the mechanism of various devices from a distance, as this was possible with a wire. Away back in 1903, Professor Branly, inventor of the Coherer, designed an instrument which he called a distributor, making possible, when used in conjunction with a coherer, a relay and other accessories, to light a lamp, or start a little motor automatically by the control of radio electric waves.

Today many devices are in use, some of them being highly perfected and used to direct by radio ships airplanes, automobiles, torpedoes, etc. Recently an automobile was directed in Dayton, Ohio, and could be controlled from a distance of 50 miles; during the bombing tests of the Navy, the old battleship "Iowa", was entirely directed by radio from a distance of about 20 miles.

Last year, in France, an airplane fitted with automatic stabilizer and radio control apparatus, was sent up without a pilot and flown in the air for 51 minutes, covering a distance of about 70 miles over a flying field. More recently a new radio control device was designed by a French engineer, which permits several operations to be made at the same time, without being affected by interference, statics or other disturbances. These apparatus will be described later, but in this lesson we shall first explain the primitive Branly system.

THE BRANLY RADIO CONTROL APPARATUS

In his early system, Professor Branly used his coherer, which was the only practical detector known at the time. We shall not describe it in detail here, as this was done in a previous lesson of this Course. However, we may say in a few words that the coherer is a detector based on the principle of imperfect contacts; it is composed of a glass tube in which two rods are pushed, so as to leave a small air gap between their ends. This small gap is filled with metallic powder, which has the following properties:

When inserted in a circuit in series with a D. C. source of low potential, the metallic powder acts as a resistance and no current flows in the circuit, but if the coherer is submitted to high frequency oscillations, the powder coheres and closes the circuit in which the D. C. source is connected; to restore its resistance to the coherer, it is merely necessary to knock it slightly.

This property of the coherer is used in the system described here to close the circuit of a relay, which in turn operates various instruments connected in several circuits which, one by one, are connected to the battery, by the distributor. Fig. 1 shows the circuit of the coherer, which is connected in the antenna circuit and in series with the local circuit, containing a single element of a battery and the winding of the relay. The armature of this relay when attracted, closes the circuit of the battery B1, supplying the current to the tapper, which is nothing but an ordinary electric bell knocking the coherer instead of a gong.

When oscillations are received in the aerial circuit, the metallic powder contained in the coherer suddenly becomes conductive. The circuit of the battery B is then closed and the armature of the relay R attracted, closing the circuit of the tapper, which, knocking the coherer in a succession of light shocks, restores its former resistance as soon as it is not influenced any more by high frequency oscillations received in the aerial. This in itself is a radio control device, running the tapper when oscillations are received, that is, when a signal is sent from a sending set; if another circuit was connected with the tapper, it would be operated at the same time, but only one control would be obtained in this way.

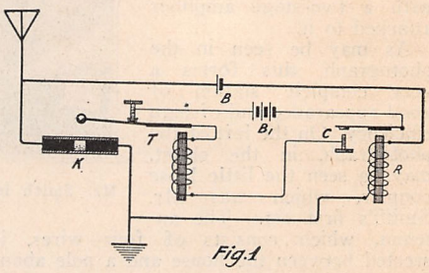


Fig. 1

The Simplest Form of Receiving Circuit That May be Used for Radio Control.

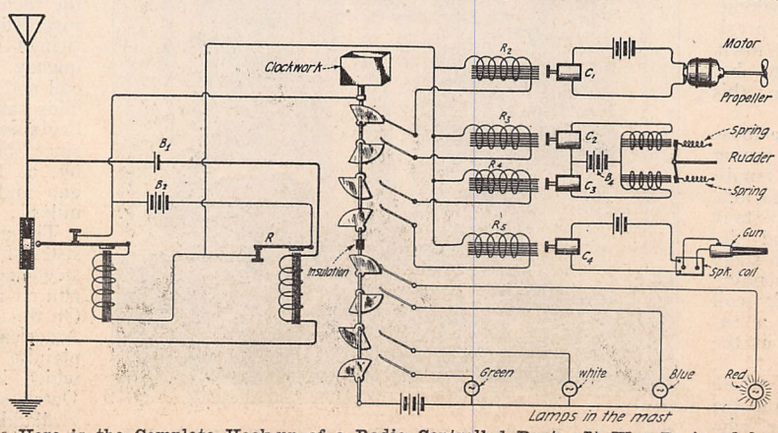
THE DISTRIBUTOR

In order to operate several devices that may be chosen at will, another instrument, which in this case is the distributor designed by Professor Branly in his early experiments, is used in this circuit. This distributor, which is shown in Fig. 2, consists of a shaft coupled to a motor or clockwork running at a known speed and on which are fixed some segments making contact one after the other with brushes fixed on the base. If to each brush are connected some lamps or other instruments with a battery supplying the current through the shaft, it may be seen that each lamp will be in circuit during the time that the segment is in contact with the brush and only one lamp will be in circuit at any time; in this case, the lamp 1 would be lit up, while the segment No. 1 would be in contact with the corresponding brush, then the lamp No. 2 would be lit up when the next segment would close the circuit, and so on.

If the distributor is connected in parallel with the tapper in the circuit of Fig. 1, and the battery B1 used to supply the current to the lamps, it becomes possible to make any desired lamp flash by sending a dot from a distant radio station at the proper moment. The receiving set, operating as already explained, but at the same time closing one or the other lamp circuit. If we know that the distributor makes one turn in four seconds, we can light any of the lamps at will by pressing the key of the transmitter during the first, the second, the third or the fourth second, at which time the corresponding segments are in contact with the brushes.

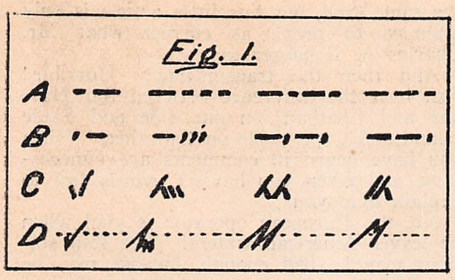
In this case the lamps, or other instruments, which may be connected to the various brushes of the distributor, are operated only

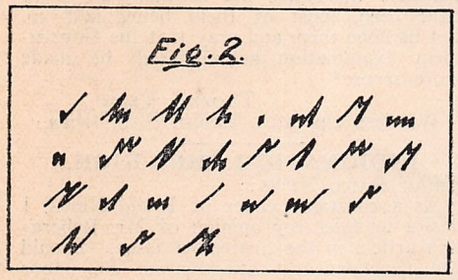
(Continued on page 456)



Here is the Complete Hook-up of a Radio Controlled Boat. It Was Designed by Professor Branly in His Experiments About Eighteen Years Ago.

Junior Constructor





For Practicing the Code, This Method of Writing is Ideal and Simple to Read and Write.

A NEW AND PRACTICAL METHOD FOR WRITING MORSE CODE.

Most Radio beginners are so situated as to be able to practice the code with someone else who is learning, but many find this impossible and are forced to resort to the use of mechanical senders, or to picking up what they can from the messages intercepted by their simple sets, it being well known that practice at sending alone will never make one proficient in receiving.

A mechanical sender represented in my own case, as in many others, too great an expenditure, and I soon found that the messages I picked up were entirely too fast to be of any help to an absolute novice.

A friend in the same predicament finally suggested a correspondence by mail, in Morse code, and this proved to be the solution of our problem. At first we wrote out the dots and dashes in the regular fashion as shown at A, Fig. 1, but this was so slow that we soon adopted the style shown at B, Fig. 1.

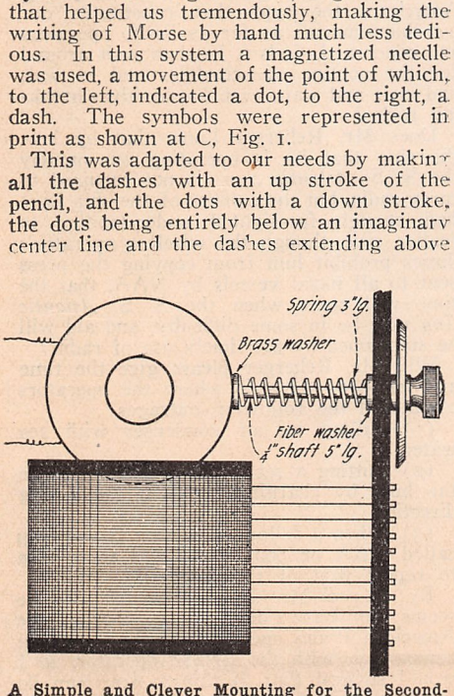
One day while reading of the old Needle System in an English book, I got an idea that helped us tremendously, making the writing of Morse by hand much less tedious. In this system a magnetized needle was used, a movement of the point of which, to the left, indicated a dot, to the right, a dash. The symbols were represented in print as shown at C, Fig. 1.

This was adapted to our needs by making all the dashes with an up stroke of the pencil, and the dots with a down stroke, the dots being entirely below an imaginary center line and the dashes extending above it, as shown at D, Fig. 1. All the parts of each letter are written without lifting the pencil from the paper. An entire alphabet is shown so as to make the idea perfectly clear, see Fig. 2.

This method proved to be very practical. Messages are easily and rapidly written and after sufficient practice, can be read almost as rapidly as if written in longhand.

We were soon able to read fast enough to take down parts of the messages intercepted, and after that all was plain sailing, but we still find it very convenient to be able to read and write in Morse legibly and rapidly.

Contributed by P. B. CROUSE.



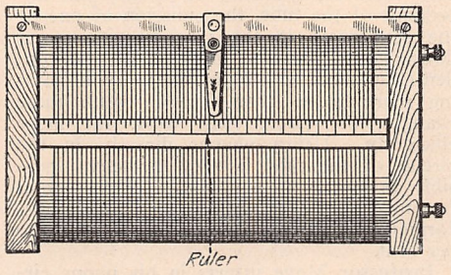
A Simple and Clever Mounting for the Secondary of a Variocoupler.

SIMPLE MOUNTING FOR VARIO-COUPLER SECONDARIES.

Having to build a variocoupler and wishing to use, as a primary, an inductance which was already wound, and on which I could not mount the necessary bearings, I decided to fix the secondary as shown in the sketch.

The form on which the secondary is wound is mounted on a shaft passing through a bearing mounted on the front panel. To this shaft is affixed the dial in the usual manner, and a spring which should be strong enough, pressing between two washers, holds the secondary in the correct position over the primary inductance.

Contributed by HARRY KENNEDY.



This Scale That You May Fix on Your Tuning Coils is Useful to Note the Tuning of a Phone Station Sending Every Day. No Time is Lost in Tuning.

SCALE FOR TUNERS.

"Where was it I heard so and so last night?" "I think it was about here somewhere." No need for this. Just take any old ruler and cut it down to fit snugly between the ends of your coupler primary, or tuning coil. You don't have to nail or even glue it into place if it is made a snug fit.

Further, you may paste a strip of paper lengthwise on the ruler on which to note the location of any station you may care to listen for at a future date. The paper can be replaced from time to time.

Mark an arrow-head with India ink on slider, and the job is complete.

Contributed by MICHAEL F. SHEA.

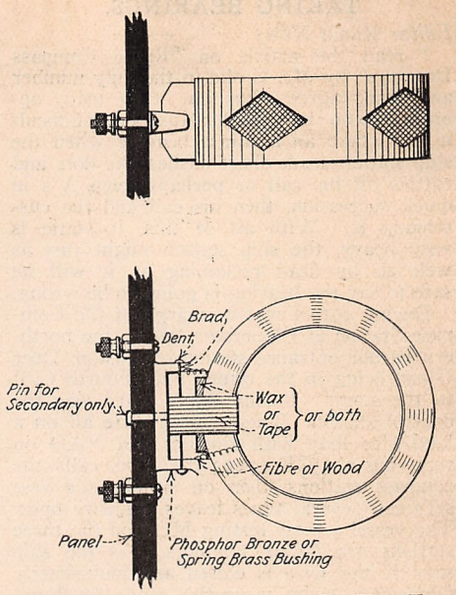
A GOOD METHOD OF MOUNTING COILS.

For the benefit of those who wind their own D-L or H-C coils and cannot suitably mount them, I give the following suggestions. No dimensions are given, because they can be made to fit any coil.

Possibly the illustration will make it clearer than an explanation in writing, but I will suggest a few things. Either red sealing wax or tape, or both, may be used, adding greatly to the strength. If only a dent is made in the spring bearings, the brass brads should have the heads left on for large contact surface. If a hole is made, the heads should be cut off and a washer soldered on. Solder the leads from the coil to the pins also. Back of the secondary drill a hole in the panel big enough to admit a pin, as shown by the dotted lines. Fasten it in with glue. In the plug of the secondary coil, drill a hole to correspond, and large enough to readily slide into place; this will hold the secondary in place. The springs should have good tension so as to insure good contact and hold the coils in adjustment when placed there. The binding posts hold the coil mount as well as serving for binding posts.

This is neater than the methods used by most amateur coil winders though it does not compare with the regular method.

Contributed by ROBERT HALE.

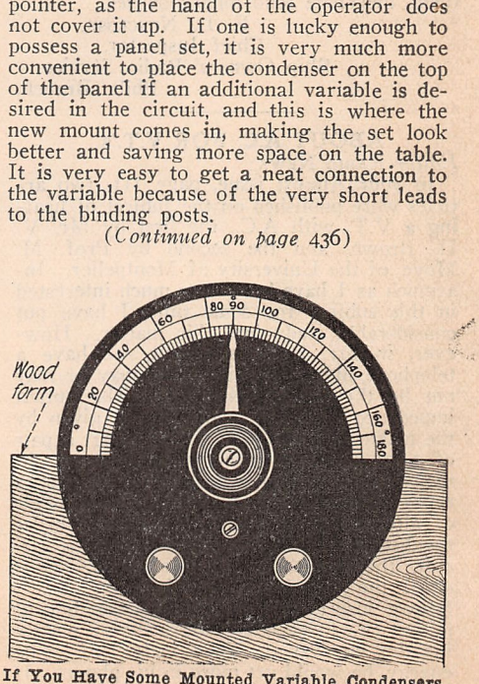


If a Mounting is Too Expensive for You, You May Make This One Yourself.

PANEL MOUNTING FOR MOUNTED CONDENSERS.

After placing my mounted condenser in all positions possible, I finally hit upon the idea of putting it in a fixed horizontal position as illustrated. The advantages of such an arrangement are: It is much easier to get exact movement of the knob and pointer, as the hand of the operator does not cover it up. If one is lucky enough to possess a panel set, it is very much more convenient to place the condenser on the top of the panel if an additional variable is desired in the circuit, and this is where the new mount comes in, making the set look better and saving more space on the table. It is very easy to get a neat connection to the variable because of the very short leads to the binding posts.

(*Continued on page 436*)



If You Have Some Mounted Variable Condensers You May Fix Them Like This on Your Table or Your Panel.

Correspondence From Readers

TAKING BEARINGS.

Editor RADIO NEWS:

I read the article on "Radio Compass Bearings" by Mr. Croke in the July number and firmly agree with him. How many operators stop to consider just how difficult it is to take an accurate bearing when the ship station sends short dashes like dots and rattles off his call or perhaps sends V's in quick succession, then his call and the customary K. With all of this, if static is very heavy, the ship station might just as well go by dead reckoning as it will be safe to say the bearing is going to be wrong.

During 1919 I was in charge of the Compass Station at Gloucester, Mass., the northern harbor entrance station of Boston, Deer Island being in the center with Fourth Cliff to the south. Boston Navy Yard was the control station. These stations are all on a land-wire loop with Boston, and NAD on receiving a QTE opens the wire, calls the compass stations, then on signing the vessel's call several times leaves the wire open. The vessel is now testing MO and the three stations are taking readings. As the ship says K the wire is closed and immediately Gloucester (who is north) sends the bearing and his sign, Deer Island and Fourth Cliff following. Boston now sends them as he receives them, i. e., Gloucester first, etc., finishing with Fourth Cliff's bearing.

If most operators would send long dashes as prescribed they would not only be helping the compass man, but themselves. We saw times when bearings were requested during really dangerous weather that we would hold our breaths and almost pray for at least one long dash or two so the reading would be accurate.

Then, too, just a word as to power. We found the bearings to be far more accurate when a ship was close (say 30 miles) if he decreased his power. If too much power was used it was very hard to determine a good minimum. In fact we often would request him to cut down power if he was too close and in this way good readings would result.

As a closing word to the Ops—think of the compass fellow. He is there waiting to serve you day or night. He may prove your best friend in time of peril. He has your interest at heart and is as anxious to give you good bearings as you are to receive them, therefore send longer dashes.

E. L. NORCROSS,
Chief Inspector,
Ship Owners' Radio Service,
Phila. Branch.

ABOUT A.C. FOR V.T.'s.

Editor RADIO NEWS:

In your August issue, page 111, two articles were published on the subject of heating a V.T. with A.C., the first by Mr. V. H. Brown, and the second by Prof. M. Moye, of the University of Montpelier. Inasmuch as I have been very much interested in this subject for some time, I have put considerable study into this matter. However, in Mr. Brown's circuit, we have a telephone induction coil. This may or may not be the best transformer. The output impedance of a U.V. 200 tube is given by the makers as 10,000 ω. If we insert a pair of 3,000 ω phones in this circuit, we are obviously not getting a maximum of energy from it, since it is an elementary principle of alternating current theory that in order to abstract maximum energy from the circuit, the impedance of the phones must equal the impedance of this circuit. Mr. Brown inserts a transformer here, but he misses the most important point of matching this impedance. Then, instead of losing energy, he would get more in his phones. If he uses a pair of 3,000 receivers, the Federal transformers reversed would make a very good match, inasmuch as the impedance ratio is 3 : 1. Furthermore, he states that the "low cyclage" current will be attenuated more than the received signal. This is obviously not so, since an increase in frequency raises both the hysteresis and eddy current losses. In fact, the 60 $\backsim$ current will go through much more easily than a 500 $\backsim$ frequency, due to these losses. The real reason his circuit diminishes the hum, is due to the fact that the condenser offers a lower impedance to the 500 $\backsim$ frequency than to the 60 $\backsim$. This is easily seen from the equation $X = \frac{1}{\omega C}$. Since C is a constant, X will vary inversely with ω ($\omega = 2\pi f$), or the ratio of the 500 $\backsim$ to 60 $\backsim$ will be $\frac{500}{60}$ or about 8⅓ : 1. This is, of course, the energy ratio. Furthermore, he has increased the impedance of the circuit by adding an extra condenser, and also shunted a condenser around the phones. This condenser around the phones, since it offers lower impedance at 500 $\backsim$ than at 60 $\backsim$ will pass more of the 50 $\backsim$, resulting in lower efficiency. I would, therefore, suggest the following changes in the circuit, replacing the induction coil by a variable ratio transformer, to match the impedance of the tube, the omission of one of the condensers in the free circuit, to cut down losses, and the omission of the condenser in shunt to the phones, to avoid passing more 500 $\backsim$ than 60 $\backsim$. With these changes, the circuit will work far more efficiently. Using phones directly in the circuit of the tube is very inefficient, possibly as low as 10 per cent. By correcting for impedance even with an inefficient transformer, this can be brought up to 60 or 70 per cent.

Professor Moye inserts in his phone circuit a galena or other crystal rectifying device. This will cut down the hum, yes, but also the signal. For the crystal allows, say, only the upper half of the cycle to pass, and even this attenuates it, but also, it will do the same for the signal. Better results, therefore, will be obtained, if this is omitted entirely. His idea of a tuned circuit for elminating the 60 $\sim$ is good although care must be taken to eliminate the third harmonic of 180 $\sim$, which is frequently very prominent, particularly in small installations of generating plants.

I trust these explanations and suggestions may help some of the bugs.

I. G. WILSON,
Ex-Chief Opr. 9YC (Univ. of Ky.).

ABOUT AMERICAN OPERATORS.

Editor RADIO NEWS:

When I arrive in an American port I always buy a couple of issues of RADIO NEWS, and when I reached Portland, Me., a short time ago, I found in No. 3, 1921, an article called "Should the Government Examinations Be More Severe?" I was glad to find that there still lives at least one honest American operator, the author of that article.

He is perfectly right when he says that U. S. wireless stations are the horror of the seven seas. He mentions having heard a Hog Island man calling NAA for a report of the weather forecast. I have heard one of his "compatriots" calling Nauen on 600 meters for the same reason. Another I have heard for five minutes calling GLD —Land's End—while this station was transmitting navigation warnings, and thus, through his utterly mad tuning, making it impossible for other stations to hear GLD distinctly.

I could mention countless examples of the same kind, but this little article is only intended to prove as correct what Mr. Charles A. Reberger says.

And then the transmitting! Horrible! Just hear the difference between Bar Harbor and Chatham on one side and Sable Island and Cape Sable on the other. When you have heard it, comments are unnecessary, and when you haven't, words fail to explain it to you.

No, the European operator is glad when he leaves American waters. The ship stations may be bad enough, but we may be thankful there are not as many as there have been, most of them being laid up. Let us hope then, and pray that the Government examination actually *will* be made more severe!

THORKIL VEIBEL,
Wireless Operator, Danish S. S. *Wien.*

INDIGNATION RUNS HIGH.

Editor RADIO NEWS:

As a constant reader of RADIO NEWS, I desire to voice my opinion of Mr. Reberger's article in the September issue, "Should the Government's Examination Be More Severe?"

What Mr. Reberger writes is sheer nonsense, and it would certainly demand thorough thrashing out to prove every word he says.

Does Mr. Reberger honestly believe he got his license by bluff

Can Mr. Reberger show examples of repairs done on the radio set of a ship that did not come under one of the questions asked by the Government?

Has Mr. Reberger read the "Bible" issued by each "maintaining radio company" and still found that there was doubt about charges on types of messages or how to fill out abstracts?

Can Mr. Reberger prove that Rome was built in a day, and that all men should be experts in handling a key the moment they set foot aboard ship?

Does Mr. Reberger know that when he communicated with British vessels at sea by means of the blinker, he was reading the deck officer's sending? Because Britishers are required to know the Morse code to get their licenses. So why not have our mates know the same for their licenses? Radio men are strictly Radio men on British ships.

Does Mr. Reberger know that a young American, the type that constitutes our merchant marine as far as Radio operators are concerned, finds it hard to wait around for the routine of schedules and to wait and wait and wait, even harder than breaking rocks?

Does Mr. Reberger know that by law, the ship that he is operating on—namely the S. S. *Atlantic Sun*—is not required to carry radio, but the owners of the ship have had enough far-sighted understanding to realize even though the wireless operator's duties prohibit him from copying the press sent to all naval vessels by NAA, that the time will come when the S. S. *Atlantic Sun* may be in some difficulty, and aid will be summoned by the timely use of radio?

Will Mr. Reberger please give the time and name of the ship where the operators committed the following outrages?

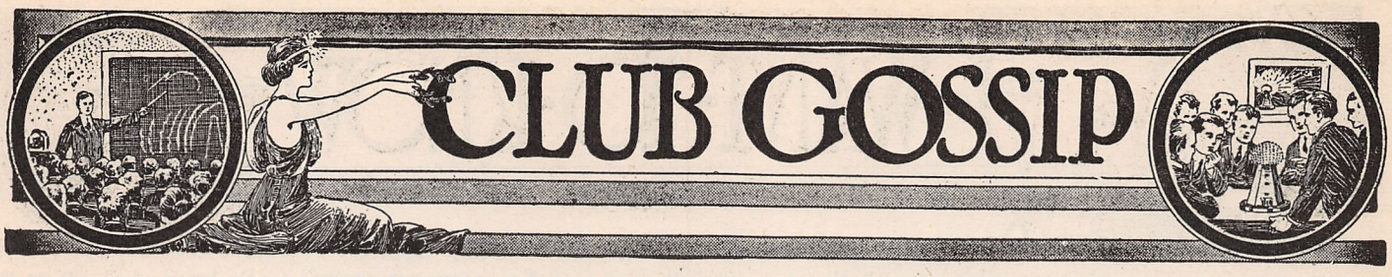
(1) Filling an air condenser with sea water.

(2) Putting a set of storage batteries on the bum by charging them in the wrong direction.

(3) When a fellow on a Hog Island ship called NAA on 600 meters and asked him to repeat part of the forecast.

By all of Mr. Reberger's remarks he seems to have deliberately chosen the American Radio operator for the "goat" in comparison with the British operator, so I would suggest that, if things American do

(*Continued on page* 430)



RADIO CLUB OF AMERICA

At the last meeting of the club at the Columbia University on Sept. 30, a very interesting paper entitled "Description of Radio Station 8XK," was read by Mr. Frank Conrad, assistant chief engineer of the Westinghouse Company. A very complete description of this medium power C.W. and phone station was followed by comments, and Mr. Conrad gave the members present very valuable "dope" on C.W. and radiophone transmission.

Address all communications to Mr. R. H. McMann, corresponding secretary, 380 Riverside Drive, New York City.

LONG BEACH, CALIF., RADIO RESEARCH ASSOCIATION

The Long Beach Radio Research Association was organized in June, 1921, and is making real progress toward establishing a big radio station. The club is not a part of, nor has it any connection with, any club previously organized in this city under a similar name, as this is the only one besides that in the high school.

The club house is being built now on the Earl Daugherty Aviation field and will be used to some extent in connection with airplane communication in the vicinity, as there is a great deal of aviation on the Pacific Coast. Two tall Eucalyptis poles about 70 feet high have been hauled to the grounds and are being placed in position. The station will have a one K.W. spark set and a phone set of 20 to 50-watt power. It is expected that long distance communication will be a regular occurance. The set will bark on 375 meters wave-length.

A tour of inspection has been planned to include some of the larger stations in the vicinity so that members will have a chance to see what is being done in the commercial and governmental way. This tour will include the large 30-K.W. arc station under construction near Hynes; the radio plants aboard the warships at anchor in the harbor; the compass station in San Pedro, and the one at the submarine base.

Full information concerning the club and its activities may be obtained from Robert Portis, 2500 Elm Ave., Long Beach, Calif. The officers of the club are: Robert Portis, president; J. Cutting and G. Shoeman, secretaries; Will Kersting, treasurer; Ralph Haynes, chairman of publicity.

ANSONIA, CONN., RADIO ASSOCIATION

The Ansonia Radio Association of Ansonia, Conn., was organized September 21, 1921. Its object is the bringing together of the amateurs of the vicinity who are interested in radio communication and desire to become more familiar with the radio art.

Progressiveness shall be the keynote of this organization and a general diffusion of knowledge pertaining to radio communication, its endeavor.

The officers of the association are: President, Alan W. Hotchkiss; vice-president, Henry F. Kulikowski; secretary-treasurer, Thomas C. Crocker.

We would be glad to hear from some of the older clubs as to procedure carried out at meetings, etc. Drop us a line and give us your routine work. We are new and advice is welcome.

All communications should be addressed to the secretary-treasurer, Thomas C. Crocker, 50 Locke Street, Ansonia, Conn.

CARSON AMATEUR RALIO ASSOCIATION

The first meeting of the Carson Amateur Radio Association was held July 7, at the home of the chief inspector. The following officers were elected: President, C. F. Riley, Jr.; chief inspector, Herman Keyser; and chief operator, John W. Mackey. The charter members of the association number nine, but the membership has grown greatly.

The purpose of the association is to help new "hams" along, to enable them to have a radio set at their disposal and to obtain instructions in radio of all forms. Code practice and instructive talks are being arranged for.

Correspondence from other clubs is invited. Address all communications to John W. Mackey, 311 West King Street, Carson City, Nevada.

HAVERFORD TOWNSHIP HIGH SCHOOL RADIO CLUB

After a rather inactive summer, the members of the Haverford Township High School Radio Club, have started preparations for the coming winter. At a meeting held on October 4, means of raising money were discussed, and officers were elected for the ensuing term. The results were as follows: William Marsh, 3VI, president; Lyman Warner, vice-president; Harry Walls, 3AWD, treasurer, and Edward H. Bryant, Jr., 3WL, secretary. Robert Crisman was given charge of the preparation of the receiving set, and William Marsh and Edward H. Bryant, Jr., charge of the sending set. Address all communications to Edward H. Bryant, Jr., secretary, 16 Llandaff Road, Danerch, Pa.

GARDEN CITY RADIO ASSOCIATION

The Garden City Radio Association was formed for the purpose of helping amateurs in the Niagara District. There were about twenty amateurs at the first meeting, at which the following officers were elected: President, F. W. George; vice-president, G. A. Threader; secretary, R. Ansell, and treasurer, C. Howarth.

Code practice and lectures are now being given. Communications from other clubs are invited. Address them to the secretary, R. Ansell, 105 Ontario St., St. Catharines, Ont., Canada.

TRAFFIC RULES AND REGULATIONS

Determined by the Executive Radio Council of the Second District, N. Y.

Rule 1—Hours 7 A.M. to 7 P.M., Eastern Standard Time. Free air for all forms of transmission, including testing.

Rule 2—7 P.M. to 9.50 P.M. Local transmission only. If high-powered stations desire to transmit during this period the input of transmitter must be reduced so as not to exceed ¼ K.W. Testing by any station during this period will be done only on last ten minutes of each half hour —20 to 30 minutes or 50 to 60 minutes, except last ten-minute period.

Rule 3—10.10 P.M. to 1 A.M. Long distance traffic only. Only such stations as have been designated by the Traffic Supervisor as long distance traffic stations will transmit during this period.

Rule 4—1 A.M. to 7 A.M. Free air for distance work of all kinds.

Rule 5—The above includes all classes of stations—spark, C.W., I.C.W. and radiophone.

Rule 6—Radiophone broadcasting of speech and music is to stop at 9.50 P.M.

Rule 7—All work by general or restricted amateur stations will be done by wavelengths not exceeding 200 meters, and with a proper legal decrement.

Rule 8—All stations must be operated on reduced power whenever possible to avoid unnecessary interference.

Rule 9—Spark stations in calling will transmit the call of the station wanted three times and sign off three times—no more—with two minute intervals between calls.

Example—2BK, 2BK, 2BK de 2JU, 2JU, 2JU.

If a station called does not answer after having been called three separate times, do not repeat the call for 15 minutes. In answering calls, make the call letters of the station which has called three times, sign the letters of the station called once, and end with K.

Example—2JU, 2JU, 2JU, de 2BK-K.

This procedure should be followed both in long-distance and local work. C.W. stations when calling other stations, are allowed a double-length call. Call three times, sign three times, call three times, sign three times.

Rule 10—No station should transmit unless the operator is sure other near-by stations are "clear."

Rule 11—Instructions for routing traffic will be issued by the Traffic Supervisor according to conditions, but as a general rule traffic should be relayed to the stations best equipped or situated to handle it.

Rule 12—The International abbreviations must be used whenever possible. Conversations should be brief.

TUALATIN RADIO ASSOCIATION

The Tualatin Radio Association, with headquarters at Cornelius, Oregon, was recently organized. Officers are: Roy Hughes, president; Jessie Watson, vice-president; Leslie Long, secretary-treasurer; Frank Hargrave, sargeant-at-arms.

Lessening of interference and encouragement of C.W. transmission were the principal reasons for organizing.

ROSELLE PARK AMATEURS FORM RADIO CLUB

A large number of enthusiastic Roselle Park wireless amateurs, eager to promote more interest in the wireless game, together with establishing closer friendly relations, recently assembled at the home of Russell T. Fink, with the idea in view of organizing a club.

The meeting was called to order at an early hour, when the possibilities, advantages and educational benefits derived from an organization of this character was a long and eagerly discussed topic. Mr. Fink, the proposer of the club, generously offered the use of a finely furnished and fully equipped building as the club's headquarters. The offer was accepted and a vote of thanks tendered the donor. On the ground floor is a fully equipped machine shop, while the second story is given over to a large meeting hall and lounging room. A large, fully stocked bookcase, located at one end of the room, comprising nearly every radio publication in existence, is part of this room's equipment. Thus members will be able to obtain any data pertaining to radio which may have been published months ago.

Numerous excellent ideas and suggestions were offered by Robert H. Horning and were met with much favor and approval. After various other questions relating to radio were discussed, the Roselle Park Radio Association was born. The nomination and election of temporary officers followed. R. T. Fink was unanimously elected as the organization's president, while Robert H. Horning was elected to fill the vice-president's chair. The election of Charles A. Reberger as secretary-treasurer next followed.

In the near future, members of the club will construct a ½-K.W. telephone outfit and a spark set of probably similar power. The antenna, which will be used, is one recently constructed by the president, and the distance between masts measures nearly 150 feet. In height, it towers almost 100 feet above the ground. It was also planned to install a piano in the building for the pleasure of the members. In the future, various radio organizations will be extended an invitation to inspect the elegant clubhouse of this new club, which promises to be one of the most thriving in the State of New Jersey. It was planned to later become affiliated with the Union County Radio Association, but this question was left until the next meeting, to be decided upon. All interested residents are invited to write to the secretary for full information regarding dues, meeting nights, etc., or by getting in touch with 2BCC or 2KK. The secretary's address is 423 Willow Ave., Roselle Park, N. J.

RADIO CLUB OF LONG ISLAND

The Radio Club of Long Island held its first meeting Tuesday evening, Oct. 4, and looks forward to a successful and interesting season. Several matters of vital importance to all amateurs were taken up, also the forming of a code class. All amateurs are cordially invited to attend our meetings on the first and third Tuesdays of every month, at Schoeck's Hall, Broadway and 14th Ave., Astoria, L. I., at 8.15 P.M. For further information, address E. Fenn, 241 W. 109th St., New York City, N. Y.

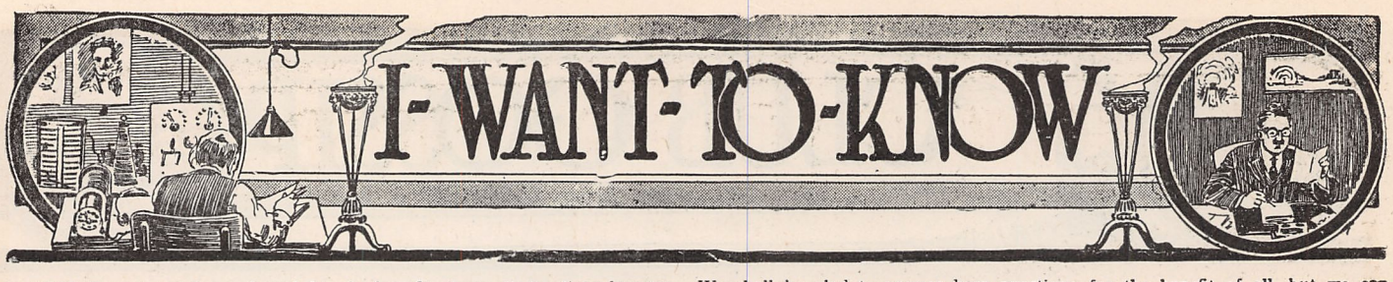
GREEN BAY RADIO CLUB

The Green Bay Radio Club has recently been organized here and promises to become a flourishing institution. The club has been formed for the purpose of creating an interest in radio telegraphy and to encourage and help amateurs in this district.

Several prominent Green Bay business men are associate members of the Club. Due to the efforts of Mr. Julius E. Kaye, financial assistance has been secured, and the success of the club in a large measure is due to this aid.

A powerful radio station is now being constructed, and it will be completed in one month. The officers of the club are: Milan Boex, president; Willard E. Jones, vice-president; Gordon H. Brozek, secretary-treasurer. All correspondence should be addressed to the secretary-treasurer at 514 Northern Ave., Green Bay, Wisconsin.

(Continued on page 443)



THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you make your letter as brief as possible.

DE FOREST BUZZER RADIOPHONE

(273) Reonard Tulouskos, of Chicago, Ill., writes:

Q. 1. Please publish a hook-up of the DeForest buzzer radiophone.

A. 1. This hook-up appears on this page.

AERIAL DESIGN.

(274) Norman L. Rowe, of Jersey City, N. J., desires an answer to the following question:

Q. 1. What length should an inverted "L" type of aerial be, which is 60 feet high and is composed of three wires spaced 3 feet apart, used in transmitting and receiving on 200 meters?

A. 1. This aerial should be about 70 feet long.

AMPLIFIER CIRCUIT

(275) Charles E. Beckwith, of Pullman, Wash., wants to know:

Q. 1. Some amplifier circuit diagrams show a condenser in the grid circuit of each amplifier bulb, while others do not. Which is the better practice?

A. 1. A condenser is not necessary, and is often detrimental in the grid circuit of an audio frequency amplifier.

Q. 2. I have one of the old style tubular Audiotron detector tubes, which emits a low pitched howl when tuned to the critical point for telephone reception, but if tuned above this point, it is perfectly quiet.

A. 2. It is difficult to say why your tube howls at a certain wave-length, without knowing the characteristics of your set; it may be caused by the internal capacity of the tube which causes it to oscillate at a certain wave-length. You might also try different values of grid leak and condenser, and vary the plate voltage.

Q. 3. What size of variable condenser would you recommend for bridging across the phones?

A. 3. A .0005 mf. or .001 mf. condenser is suitable for shunting the telephones.

RECTIFIER CONSTRUCTION

(276) William Feustel, of Passaic, N. J., sends the following inquiries:

Q. 1. Where can I buy the lead and aluminum plates used in the rectifier shown on page 201 of the September, 1921, issue of Radio News.

A. 1. We suggest that you communicate with Patterson Brothers, 27 Park Row, New York City, N. Y., for this.

Q. 2. Where can I get a loud speaker, without the mechanism?

A. 2. Almost any phonograph house could supply you with one of these.

INDUCTANCE FORMER

(277) George Williger, of Erie, Pa., asks for this information:

Q. 1. I am making coils and would like to know which are the better, wooden, or cardboard tubes.

A. 1. Thick shellacked cardboard tubes are better.

Q. 2. Does the book, "A Thousand and One Formulae" tell how to find the wave-length of coils and other instruments?

A. 2. No, see the "Wireless Course in 20 Lessons," published by the Experimenter Publishing Co.

RECTIFIER.

(278) J. D. MacGregor, Jr., of Stamford, Conn., would like us to tell him:

Q. 1. In the article, "A and B Batteries on 110 Volts A.C.," which appeared in the September issue of Radio News, the author did not state how much ammonium phosphate to use in the solution for the rectifier; please tell me what solution to use.

A. 1. The solution of ammonium phosphate is a saturated one.

CAPACITIES.

(279) Robert Topp, of Syracuse, N. Y., wants to know:

Q. 1. What is the best value of capacity for the aerial, secondary, telephone and grid condenser, and what is the resistance of the grid leak in a circuit using a C300 tube?

A. 1. The aerial condenser should be .001 mf.; the secondary condenser, .0005 mf; the telephone condenser, .002 mf.; and the grid condenser, .00025 mf. The grid leak should be of about ½ megohm resistance.

AMPLIFIER.

(280) Bob Okell, of Bloomington, Ill., would like some information:

Q. 1. What number of stages of amplification is most practical for an amateur station?

A. 1. Two stages of audio frequency amplification are quite satisfactory for an amateur station.

Q. 2. Will four to six stages give much trouble from howling?

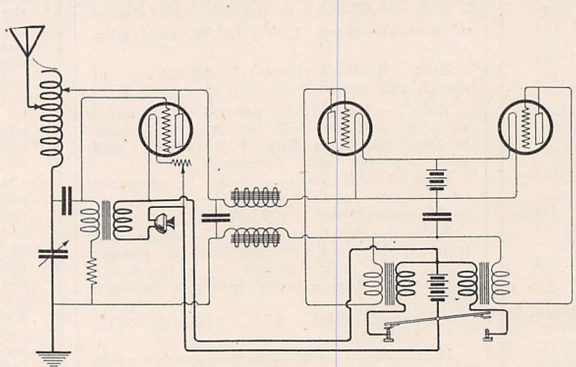
A. 2. Yes, howling would be evident if more than three stages of audio frequency were used with efficient transformers. Some steps of radio frequency amplification may be used before detection.

AMATEUR SET.

(281) Walt Bryant, of San Diego, Calif., sends in a hook-up and asks:

Q. 1. Is the accompanying hook-up practical for an amateur station?

A. 1. Yes, but the value of plate inductance should be adjusted for each wave-length.



This Radiophone Uses Only Two Six-Volt Batteries as Power Supply. The High Tension is Obtained Through a Buzzer Transformer, and Rectifier Tubes.

Q. 2. Would such a set receive phone signals?

A. 2. Yes.

AERIAL WAVE-LENGTH.

(282) W. E. Lavender, of Nashville, Tenn., writes:

Q. 1. What is the natural wave-length of an inverted L, four-wire aerial, the wires being 75 feet long, 20 feet high and 2 feet apart?

A. 1. The natural wave-length would be about 145 meters.

Q. 2. What is the wave-length of an inverted L, four-wire aerial, wires 2 feet apart, 75 feet long, one end 25 feet high, the other end 30 feet high?

A. 2. The wave-length in this case would be about 137 metters. Of course the wave-length is effected by the surroundings of the aerial and may vary if the latter is erected on a building, or over trees, etc.

RADIO DICTIONARY.

(283) Theodore Breyer, of New Philadelphia, Ohio, has sent the following query:

Q. 1. Where can I obtain a complete radio dictionary which gives the technical terms used in radio telegraphy and telephony?

A. 1. A dictionary of the terms used in radio may be obtained from the Wireless Press, 326 Broadway, New York City, N. Y.

DIRECTIONAL EFFECT OF AERIALS.

(284) Harry C. Wirth, of New York City, wants to know:

Q. 1. What is the directional effect of a "T" aerial and an inverted "L" type?

A. 1. The range obtained with a "T" aerial is greater in the direction of the ends of the flat top. With the "L" type, the range is greater in the direction of the lead in. The longer the flat top and the lower the aerial, the more is the directional effect increased.

Q. 2. Is there any difference in the directional effect when receiving and when transmitting?

A. 2. The directional effect may be observed at the reception as well as transmission. However, it is not so marked when receiving only.

POWER TRANSFORMER FOR RADIOPHONE.

(285) Paul Glen, of Jersey City, N. J., requests a reply to the following:

Q. 1. Could I use a step-up transformer delivering about 250 volts to be used with the radiophone set as described in the March, 1921, issue of Radio News?

A. 1. Yes, if you use a transmitting tube such as a radiotron U.V. 202, and providing the transformer has a center tap, and is to be used with rectifier tubes. Otherwise, two transformers should be used with primaries in parallel and secondaries in series, the middle connection being the center tap.

SHIELDING OF PANEL.

(286) Mr. R. E. Fellows, of Cleveland, O., wants to know:

Q. 1. Can a good ground be obtained by burying 24 feet of sheet copper 10 inches wide, edgewise, in a trench two foot deep?

A. 1. Yes, this would constitute a good ground, especially if buried in a damp place.

Q. 2. Does backing the panel of a sensitive receiving set with sheet copper and grounding same, eliminate capacity effects of the operator's body?

A. 2. Yes, this shielding of the panel is very efficient to prevent capacity effect from the operator's hand when tuning.

Q. 3. Will the DeForest .0005 condenser work efficiently as a grid condenser in connection with the Radiotron or Cunningham tubes?

A. 3. Yes, this would be a good grid condenser.

I.C.W. TRANSMISSION.

(287) J. G. Schroeder, Wiener, Nebraska, wants to know:

Q. 1. What would be the average range of an I C W tube transmitter using two Radiotron power tubes U.V. 202?

A. 1. Using a good aerial and counterpoise, with 350 to 400 volts on the plates, the range may be 80 to 100 miles under good conditions.

Q. 2. Would four tubes double the range using I C W and same tubes?

A. 2. No, not quite double it. but increase it about ½ to ⅔ the former value.

Q. 3. Is it necessary that a counterpoise ground be insulated?

A. 3. Yes, a counterpoise should be as well insulated as the aerial.

SPARK COIL C.W. SET.

(288) W. P. Taysitor, of Millville, N. J.:

Q. 1. Can the C.W. set, described by Mr. Pruden in the November, 1920, Radio News, be used as a phone set by inserting a microphone?

A. 1. No.

Q. 2. Where can a spark coil. used in the above set. be bought?

A. 2. You can build such a coil by using the primary from a ¼ inch spark coil, with the secondary of a ⅛ inch spark coil. which may be obtained from the Electro Importing Co., N. Y. C.

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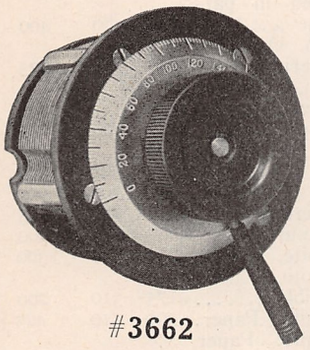

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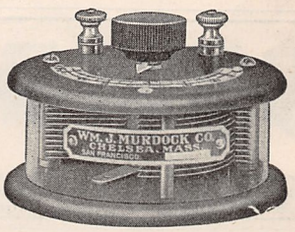
43 PLATE .001 MFD.		*23 PLATE* .0005 MFD.	
#3660	$4.00	#3680	$3.25
#3661	$4.25	#3681	$3.50
#3662	$5.00	#3682	$4.25

FRONT MOUNTING TYPE

#366	$4.75	#368	$4.00
#367	$4.50		



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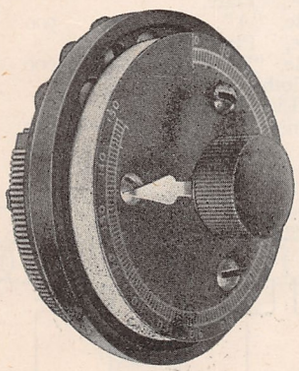

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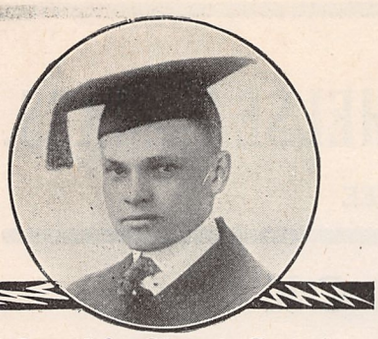

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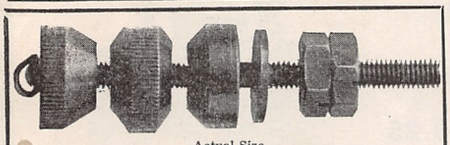

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High Voltage Dynamos

(Continued from page 395)

considerable resistance when they short-circuit two or more segments of the commutator and thus reduce flashing and sparking. In the case of the dynamotor, the armature and field should be selected so that the armature will have sufficient space in the slots to contain the motor and dynamo windings. In other words, a 500 watt machine which might have been a motor, may be redesigned to contain both motor and dynamo windings on the armature, but having a rating of approximately 250 watts each. The armature coils are wound the full length of the core slots one over the top of the other, as shown previously. Each winding should be completed before the other one is started, and suitable insulation placed between the windings.

At Fig. 8 a circuit is shown for an inverted rotary converter. Oftentimes radio and electrical experimenters desire to obtain sine wave alternating current from D.C. service mains. This is easily accomplished by connecting two wires from diametrically opposite segments of the commutator on a D.C. motor, for example, and arranging these two leads, as shown, to connect up with two slip rings, which are usually placed on the opposite end of the armature shaft to that occupied by the commutator for convenience sake. If there is room between the commutator and the bearing, the slip rings may be placed on a fiber drum or disk alongside of the commutator. The two slip rings may be cut out of brass sheet and screwed to a thin fiber disk so as to occupy very little space, as shown at Fig. 8-A. If the slip rings are placed on the pulley end of the armature, as shown at Fig. 8-B, the two lead wires from the A.C. slip rings are usually secured in two slots, as shown by the dotted lines, and are then connected to the two armature coil leads, 180 degrees apart, or they may be soldered to diametrically opposite commutator segments.

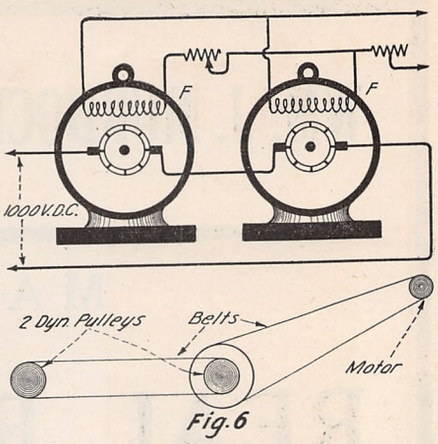


Fig. 6

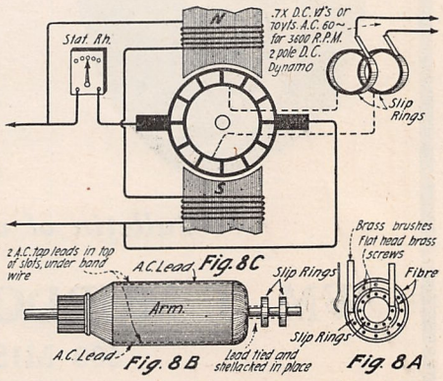
High Voltage May be Obtained by Connecting Dynamos in Series and Running Them at the Same Speed.

TABLE OF INSULATING MATERIALS

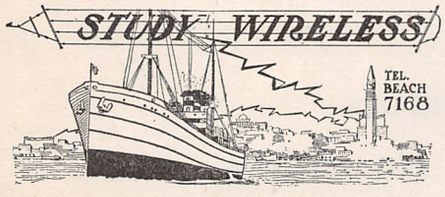
From Wiener

Material	Specific Disruptive Strength Limits, in Volts per mil Thickness	Practical Average Volts per mil	Practical Average Volts per m.m.
Asbestos	100- 180	125	5,000
Asbestos, oiled..	225- 490	300	12,000
Asbestos and Muslin, oiled..	330- 500	375	15,000
Cotton, Single Covering (on wires)	260- 340	275	11,000
Cotton, Single Covering, shellacked	340- 370	350	14,000
Cotton, Single Covering, boiled in paraffine	380- 480	400	16,000
Cotton, Double Covering	210- 240	225	9,000
Cotton, Double Covering, shellacked	250- 300	275	10,000
Fiber, vulcanized, red	150- 325	200	8,000
Hard Rubber....	900-1,300	1,000	40,000
Leatheroid	150- 250	175	7,000
Mica, pure, white	2,000-8,000	3,000	120,000
Micanite, Cloth..	240- 590	300	12,000
Micanite, Cloth, flexible	175- 310	200	8,000
Micanite, Paper.	390- 510	425	17,000
Micanite, Paper, flexible	280- 390	300	12,000
Micanite, Plate..	940-1,120	1,000	40,000
Micanite, Plate, flexible, "A"..	830-1,040	900	36,000
Micanite, Plate, flexible, "B"...	575- 790	600	24,000
Oiled Cloth (Cotton, Linen or Muslin)	450- 650	500	20,000

(Continued on page 444)



A Rotary Converter May be Inverted, and Deliver A.C. When Supplied With D.C. Fig. 8C Shows the Hook-up.



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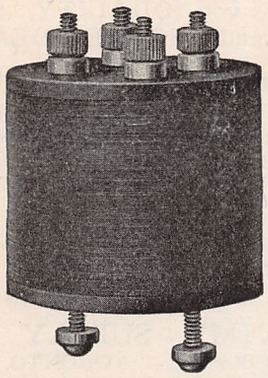

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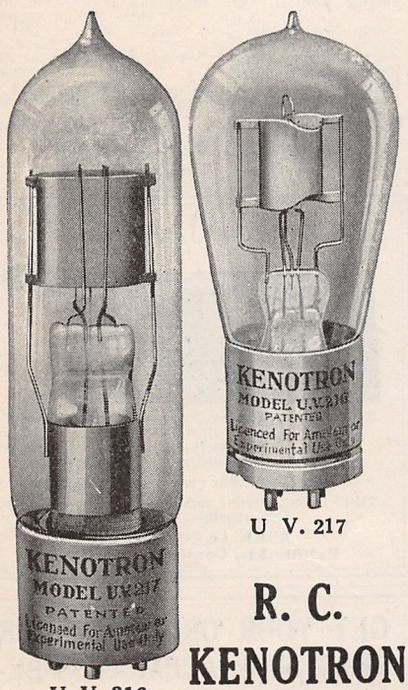

U. V. 217

U. V. 216

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3	Condensers	3.00
1	Grid Leak 10.000 ohms	1.25
1	C. W. Key	3.00
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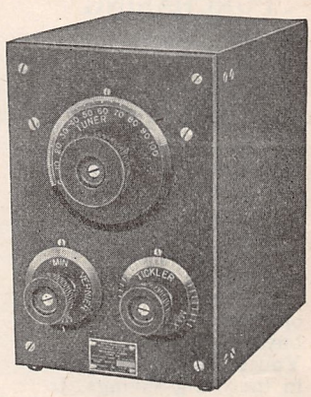

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Radio Possibilities of the Tungar Rectifier

(*Continued from page 387*)

curve. If the resistance is too small there is an enormous rise in plate current, the tube being operated in the region "AB," at which currents the tube is endangered. In other words the value of the series plate resistance is very critical and it is difficult to get the tube on the right part of the curve for oscillations.

A better understanding of this situation is obtained by considering the following: When the tube is on the "B" curve, its characteristic is falling, Fig. 4. If a positive resistance is placed in series with the tube, the total characteristic of the tube-resistance combinations is given by the sum of the individual characteristics of tube and resistance, and this is shown in Fig. 5.

If the positive resistance is much larger than the tube resistance (in other words, if the positive slope of the resistance characteristic is greater than the negative slope of the tube characteristic) the total curve which is the sum of the two becomes a rising curve and the circuit is stabilized. The value of the series resistance relative to the tube resistance determines the degree of stability, the greater the value the more stable the circuit. Thus even if the tube, with high resistance in series, does happen to come on the "B" curve, oscillations may not occur, due to the stabilizing action of the series resistance. Thus the difficulty in getting the Tungar rectifier to oscillate is that if there is resistance in the circuit the tube is made stable, or in some cases the arc may go out. If there is no resistance in the circuit, the currents in the tube are too high for operation.

Very careful manipulation of this series resistance must, therefore, be made and by so doing it is possible to obtain a critical adjustment between the above two conditions where the tube oscillates. The circuit for oscillating is similar to that used with arcs and is shown in Fig. 6. The oscillating circuit "LCR" is shunted across the tube, and has in series with it a radio frequency ammeter of very low range, up to about 50 milliamperes. "B" is the plate battery, "R_s" the series resistance, "L_1" is an inductance used as a choke for keeping the battery current constant, "S" is the switch by means of which the filament circuit is opened for bringing the tube from the "A" curve to the "B" curve. Unless the values of "R_s" and "B" are very carefully adjusted, the oscillations will become unsteady. Even when they are so at the best, the oscillations are difficult to maintain. However, the above shows that the tube can be made to oscillate at radio frequencies, and it has the necessary characteristic for this function.

High Class Workmanship in Amateur Radio Apparatus

(*Continued from page 378*)

rotor windings. On the panel, it will be seen that aluminum screens have been provided to cut out the effect of "body capacity" while adjustments are being made.

Vernier attachments have been provided, where any critical adjustment is necessary and the construction of the verniers is interesting in itself. The control knob and the little rubber tire, which is air-inflated, are mounted on the same axle and the rubber tire bears against the inner side of the dial. The only portion of the vernier which is visible from the outside of the cabinet is a small portion of the control knob.

The rheostats which are of the same design are marked in ohms.

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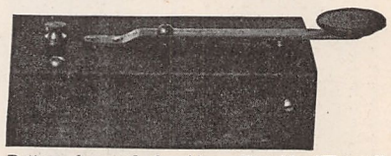

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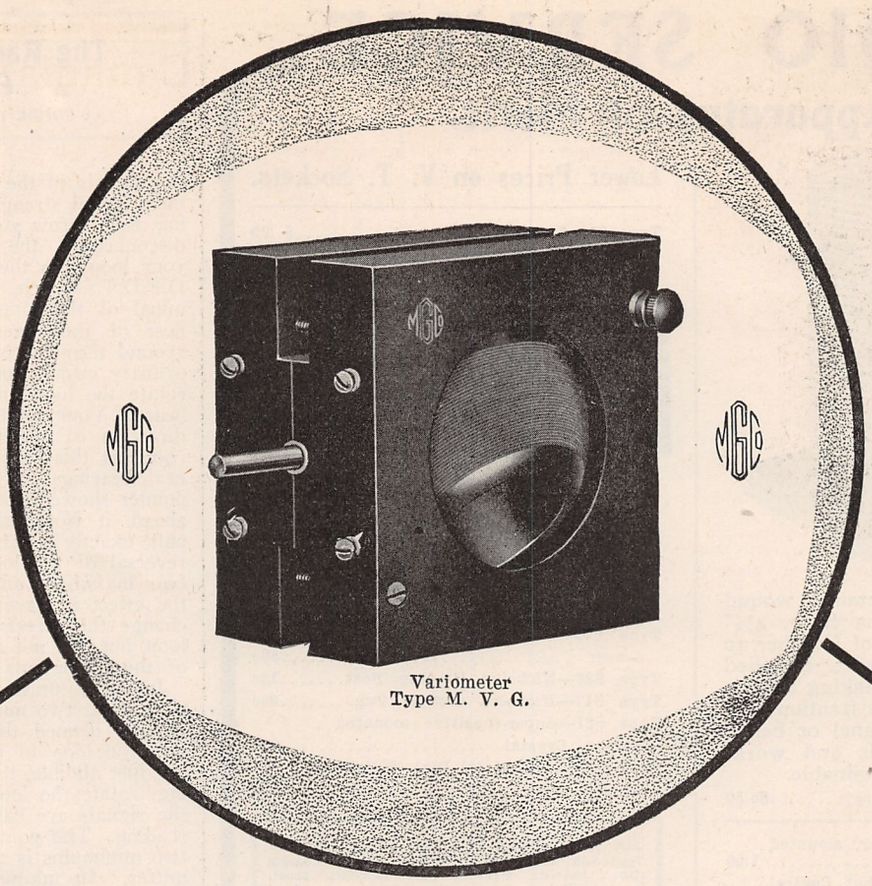

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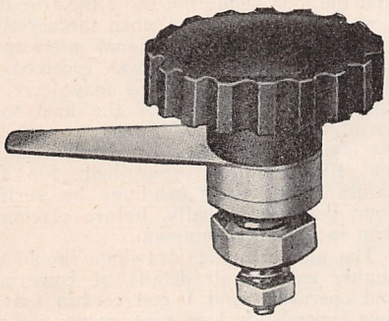
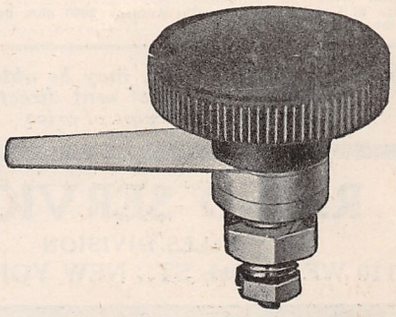
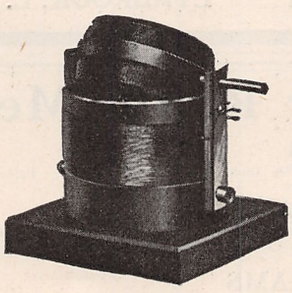


Vario-Coupler

The same inherent precision of manufacture, the same sturdiness, compactness, and neat appearance make this Vario-Coupler a fit companion for the M. V. G. Moulded Variometer. For either table or panel mounting. Size of base 5x5, height 4½". Tapped for single turn variation covering entire range. Green silk wire. Price $5.00.





Switch Arm Type S. A. 3

Price .....$ .60 each

Knob—1¼" Knurled Bakelite
Lever—1½" Phosphor Bronze Nickeled
Bushing—to fit up to ⅜" panel

Type S. A. 1 Price $ .50 each
Same as above with 1" knob

Switch Arm Type S. A. 4

Price .....$ .60 each

Knob—1¼" Fluted Bakelite
Lever—1½" Phosphor Bronze Nickeled
Bushing—to fit up to ⅜" panel

Type S. A. 2 Price $ .50 each
Same as above with 1" knob

If your dealer does not carry them, write us, giving his name.
Dealers: Order at once—the demand is big.

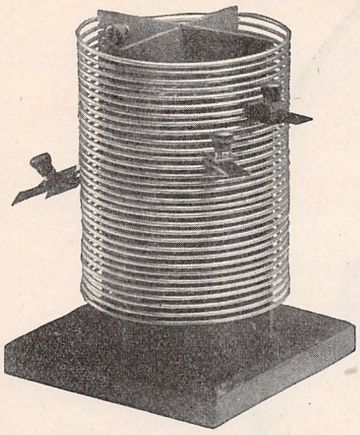
THE MARSHALL-GERKEN COMPANY

MANUFACTURERS AND JOBBERS

31 Radio Building **Toledo, Ohio, U. S. A.**

RADIO SERVICE

Apparatus of Merit



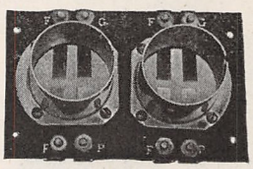
A real efficient inductance, wound on a slotted Formica form, 4½" diameter of 31 turns of Number 10 hard drawn copper wire. Supplied with 3 special clips making adjustments variable to any fraction of a turn. Suitable for panel or bench mountings. Materials and workmanship the finest obtainable.

Type S50 Inductance, price.....$8.50

C.W. Mica Grid Condenser, mounted (stands 1,800 volts)..... 1.00
C. W. Navy Type Filament Control Rheostat 2.00

Lower Prices on V. T. Sockets.

Type S10 Single Socket.....$ .90
Type S3 Double Socket..... 2.25
Type S4 Triple Socket..... 3.25



Radio Service sockets have hard drawn aluminum shells, machined bakelite bases, heavy phosphor bronze contact springs, and metal parts nickel plated.

RADIO SERVICE SMALL PARTS

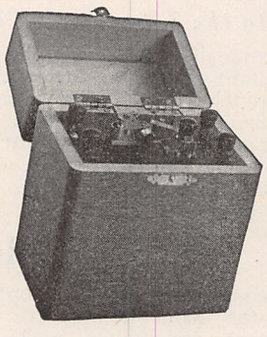
Type S15—.0005 Grid Condenser.....35c
Type S18—.00025 Grid Condenser.....35c
Type S16—.002 Receiving Cond.....35c
Type S30—Combination Grid-leak Condenser 50c
Type S26—Nickeled Binding Post.....12c
Type S17—Nickeled Crystal Cup.....25c
Type S21—Super-sensitive mounted Galena Crystal 50c
Type S28—3 in. Metal Dial, dull black finish 30c

Six grid leaks for the price of one
Type S40 leak 0 to 3 megohm in ½ megohm steps, bakelite mounted and moisture proof, for only 75c.

→ THE SENSATION OF RADIO ←

THE LITTLE WONDER PORTABLE RADIO SET, that you saw in the "movies, the daily papers, etc. Simple to install and operate. Just connect your aerial, ground and phones and you are ready to receive wireless telegraph or telephone messages and music.

A truly wonderful set within the reach of all. Over 1,000 of these sets are in service and all giving complete satisfaction.



Type S8 (as illustrated), Price.....$7.50
Type S8 with Murdock 2000 ohm headset.....11.50
Type S8A complete (incl. 75 ohm phone, aerial, insulators, blue print and instruction book).....12.50
Type S8B complete, but with Murdock 2000 ohm double headset 15.50

Radio Service Apparatus may be obtained at all reliable dealers or sent direct to you on receipt of price

RADIO SERVICE & MFG. CO.

SALES DIVISION
110 WEST 40th ST., NEW YORK CITY

FACTORY
LYNBROOK, L. I

Message Blanks for Radio Men

RADIOGRAMS

Message blanks for recording ordinary radio messages. Size 5½ x 8½ inches. 100 sheets to pad. Price, 30c per pad; $2.70 for 10 pads. Postpaid.

RELAY RADIOGRAMS

For the radio man desiring to keep an efficient record of all his station's relay traffic. Relay Radiograms offer the logical and economical method. Size 5½ x 8½ inches. 100 sheets to pad. Price. 35c per pad; $3.15 for 10 pads. Postpaid.

RADIO-POSTALGRAMS

Something new. A message blank printed on a government postal. When you receive a message for some out-of-town friend who is not equipped with radio or telephone, forward it to him on a RADIO-POSTALGRAM. Price, 25 postals, 50c; $1.70 per 100. Postpaid.

Send in your order now. We will ship it C.O.D. with privilege of inspection.

AMERICAN RADIOGRAM COMPANY
305 Broadway Dept. R-2 New York, N. Y.

READ the CLASSIFIED ADVERTISEMENTS on PAGES 468-470. YOU'LL FIND MANY GOOD THINGS THERE

The Radio Compass At Sea

(*Continued from page* 380)

the signals in the usual manner, for maximum signal strength, with the bulb oscillating, then throw your aerial switch out, thus disconnecting the main aerial, and bring your loop into the circuit by means of the D.P.D.T. switch, which connects one terminal of the loop to the antenna binding post of the tuner and the other to the ground terminal of the tuner. Retune the primary circuit for maximum signals, then rotate the loop until maximum signals are heard. Your pointer will now designate the direction of the transmitter, or its reciprocal, as this type of compass gives bi-lateral bearings only. For example, if the pointer showed maximum signals to be dead ahead, it would also show maximum signals exactly astern. Since in a complete reversal of the loop the pointer will show two maximum and two minimum signals, the effect of reversing the loop will be to change the direction of the current in the loop, but will not change the signal strength of the maximums or minimums.

In actual practice it is the usual custom to find the two minimums as they are more sharply defined than the maximums. Rotate the loop to the left until the signals are just audible, then after noting the reading, rotate the loop back to the right until the signals are barely audible and note the reading. The point half-way between these two minimums is the direction of the transmitter. In taking bearings on shore stations the Bi-lateral properties of the loop will not cause annoyance, as you always know your general direction of travel, but when working with ships you will meet with more difficulties. But in an emergency it is always possible to get the ship's position and direction of travel.

In actual experimental work at sea, I have found it convenient to keep a log of calls heard, their signal intensity from time to time, and their position reports when heard. When using the loop, be sure your aerial is not grounded, but merely left free. As in actual practice on the *Jalapa*, I found that the loop would not show the true direction of the transmitter when the aerial was grounded, although the signal intensity was about twice that which was received with the aerial left free. This may have been due to the proximity of the loop to the aerial lead in, but it is best to wait until you can get a ship or land station in sight and then calibrate your loop for slight errors on different headings by verifying your bearings visually, before placing the loop in actual commission.

The accompanying drawings should thoroughly explain all details of construction and operation, and I feel certain that any time expended in loop experiments will more than repay the Radio operator.

3 AMY East Lansdowne, Pa.

(*Continued from page* 400)

current motor delivering about 450 volts. The filaments are lighted with A.C. using a step down transformer to 10 volts.

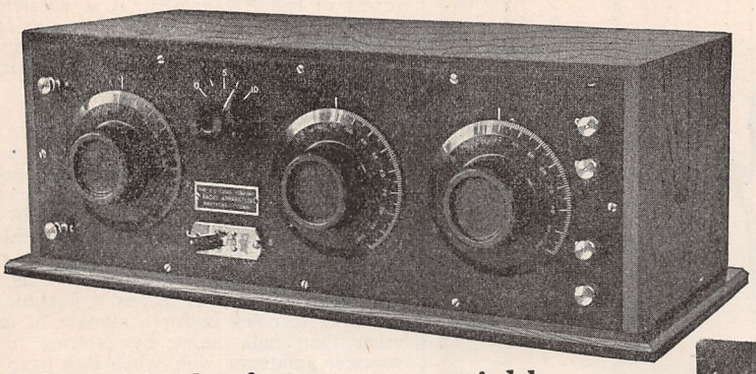
The inductance consists of 31 turns of No. 9 wire on 5½ in. bakelite form.

The filter system is a double Acme choke coil and a 2 M.F. condenser.

I would say in conclusion that I have tried all the popular circuits and find this one gives the best results on amateur wavelengths. Radiation is .8 on C.W. and .6 on modulation.

R. W. Scargle.

ASSEMBLE YOUR RADIO

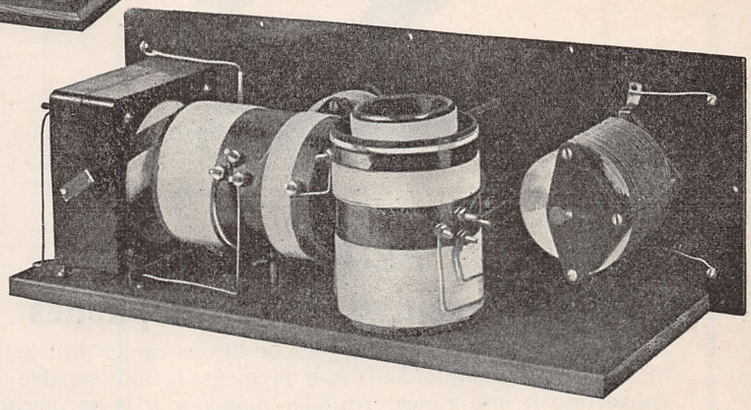


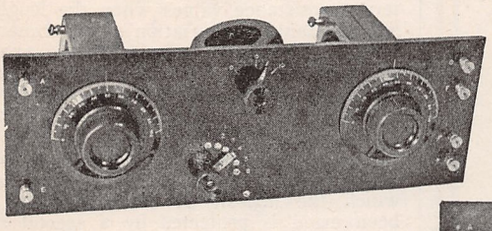
Type 220—Price $75.00
Regenerative Tuner

Wave Length Ranges
180—375 Meters
375—825 Meters

Comprised of antenna variable, secondary variable, plate variometer, coupler, wave change switch.

Price unmounted, without cabinet, $41.50

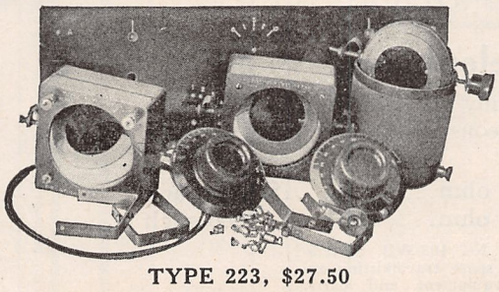




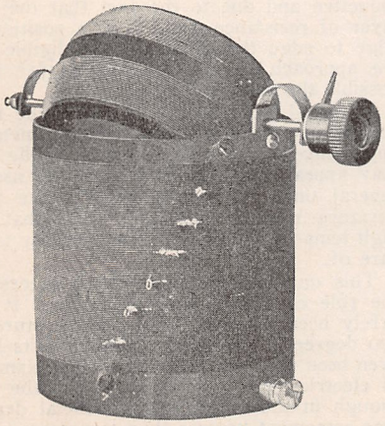
Unassembled Tuner Made of Tuska Parts

The Tuska Moulded Variometers and Variocoupler. Sold unassembled, without cabinet at **$27.50**

ILST OF PARTS	
2 Tuska Variometers	$12.50
2 Tuska Dials	3.30
1 Tuska Variocoupler	7.50
1 Drilled and Engraved Panel	5.00
2 Pair Brackets	.70
1 Switch	.35
6 Switch Points	.35
6 Binding Posts	.72
10 Feet Connecting Wire	.08
Total	$30.50



TYPE 223, $27.50



Type 230—Price $7.50

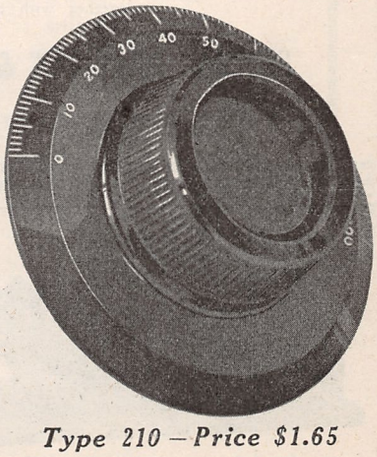
TUSKA VARIOCOUPLER

The Tuska Variocoupler is composed of moulded rotor, formica tubing, green silk wire and perfect mechanical construction. Primary 96 turns—Secondary 45 turns.

Price $7.50

TUSKA KNOB AND DIAL

For 3/16" or 1/4" shaft



Type 210—Price $1.65

Send 5 cents for our Bulletin No. 2 and Temporary Catalog

THE C. D. TUSKA COMPANY

265 HIGH STREET HARTFORD, CONNECTICUT

FEDERAL
Super-Sensitive Head-Telephones

No matter how favorable the conditions under which the message is transmitted—if the receiver is not capable of converting it into a clear readable message, it is not accomplishing its purpose.

Originally designed and built to meet the exacting requirements of army and navy specifications.

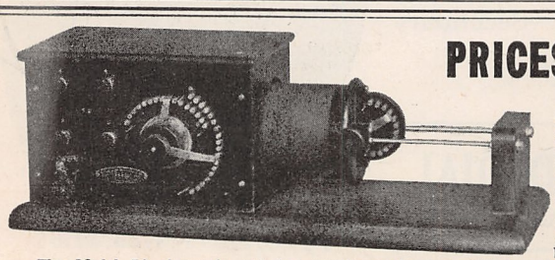
FEDERAL
Head-Telephones

are extremely sensitive, carefully matched in tone, and every part that enters into their construction is made and inspected with the greatest care.

No. 52-W.....3,200 ohm.....$10.50 each
No. 53-W.....2,200 ohm..... 8.00 each

Write for Bulletin No. 103-WB. describing latest C.W. and spark transmitting apparatus, receiving equipment and parts, together with our standard line of Radio accessories.

FEDERAL TELEPHONE & TELEGRAPH CO., Buffalo, N. Y.



PRICES CUT IN HALF

We have purchased the entire stock of The Radio Apparatus Co., including a considerable number of their famous 5A and 5C Receiving Transformers. These instruments are known around the world and have been giving wonderful satisfaction for years.

In order to get business started we have decided to sell these instruments for a time at prices that are below the cost of production.

The Model 5A shown in cut has genuine mahogany cabinet and nickel plated metal parts. It sold last year for $29.50. We are now offering a limited number for $14.75 each. The Model 5C is the same mechanically but has imitation mahogany cabinet and brass metal parts. It sold last year for $24.50 and the price for this sale is $12.25.

Both instruments are wound to receive up to 4000 meters. Don't delay if you want to get one of these wonderful bargains. Send money order or check.

AMERICAN BRASS PRODUCTS CO. Radio Division **Pottstown, Penna.**

Have your read the first issue of PRACTICAL ELECTRICS now on the news stands.? If not, get a copy today and you will thank us for reminding you.

An Ideal Radio Service

(*Continued from page 382*)

be gained by the patrons of such a store, for, in addition to learning of the newest forms of radio equipment, it is possible to try them and make comparisons with other apparatus, with which they are familiar, thus guiding themselves intelligently in their expenditures.

Handbooks as well as current radio magazines are to be found on the table and, when a circuit has slipped from one's head, it may usually be found in one of the books. Then, again, there are many advantages which are gained by the store which uses such a system, for it stimulates a confidence in the store and the merchandise the store handles, which could not be fostered as well in any other way. It makes it possible for the store to come in for a number of sales, other than radio sales, by catering to the younger amateurs, who, when they hear that their mothers are in the market for electric washers or sewing machines, are prone to suggest the dealer who has enabled them to get the most out of their radio equipments.

New Form of Resistance for Grid Leaks

(*Continued from page 382*)

and depth of the strip remain constant or the width and depth can be varied to produce different resistance values when the length is left constant. A variation of all three factors, simultaneously results in the production of units of practically any resistance and a combination of units in parallel permits the use of any desired current to be passed through them.

These units are to be had in two forms. As normally supplied the sheet of mica on which the deposit of precious metal has been made is protected by a second sheet of mica. Where the unit is to be mounted behind a panel or some other place where it is likely to be free from injury this form of unit is serviceable, but where it is to be exposed it has been found advisable to use a brass protecting case which allows the unit to be handled very roughly without injury. This may not be said of the other forms of resistances which are of the wire wound type and are commonly called "vitreous enamel units."

We find that this unit is absolutely non-inductive and due to the fact that the thin layer of resistance metal is in a position of edge to edge the capacity is negligible and we approach as near as has so far been possible the ideal resistance.

In actual working we find that the temperature co-efficient of the resistor metal is approximately that of copper. While this may appear to be a little high, the use of several units in parallel reduces the temperature rise to such an extent that the high temperature co-efficient is readily taken care of.

This unit has met with great success in the rôle of a voltmeter multiplier. It has safely been operated up to temperature of 300 degrees Fahrenheit. Similar units have even been used for years as heating elements in electric irons, curling irons and the like, though in these instances the metal deposit was somewhat heavier than is necessary for a grid leak. Here is a direct advance in the radio art.

CAN'T KEEP A SECRET.

D. Tector, to A. Battery: "The amplifier gets my goat."

A. Battery: "Why?"

D. Tector: "He repeats everything I say."

By R. I. Toran.

Correct Accessories

These selected accessories are sold by Radisco agencies, under the Radisco guarantee, and are recommended for use with Radisco instruments.

Pacent Universal Plug

Specially designed for radio work. Makes a permanent electrical contact with telephone cord tips or any solid conductors without soldering and without any special preparation or tools. *Universal use.* Price $2.00.

Dubilier Universal Mica Condenser

Uses dielectric of clear India ruby Mica. Compact, long-lived, universally useful. *Capacity absolutely constant.* Nine sizes, 1,000 volts each, ranging in capacity from .00025 to .01 Mfd. Price $2.00.

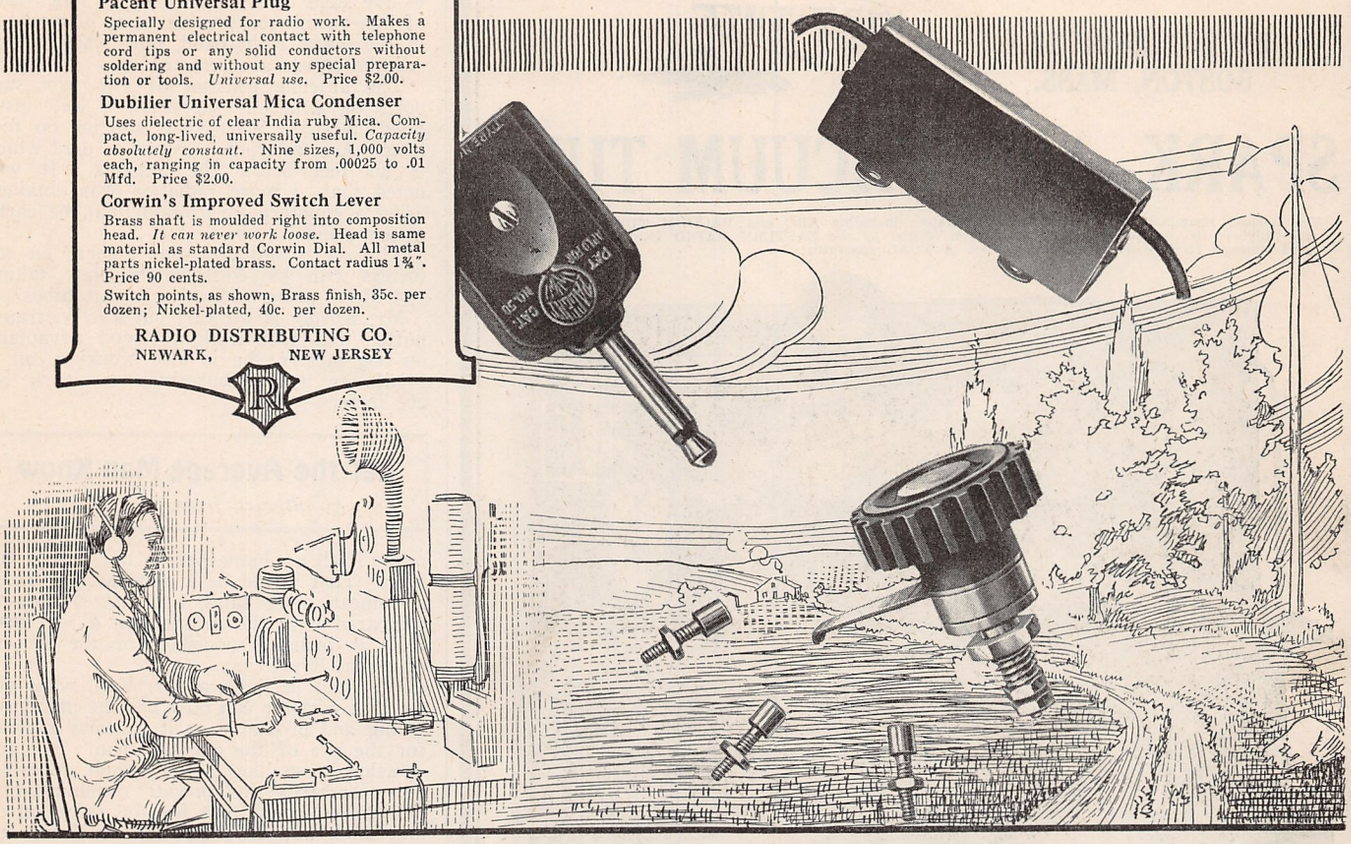
Corwin's Improved Switch Lever

Brass shaft is moulded right into composition head. *It can never work loose.* Head is same material as standard Corwin Dial. All metal parts nickel-plated brass. Contact radius 1¾". Price 90 cents.

Switch points, as shown, Brass finish, 35c. per dozen; Nickel-plated, 40c. per dozen.

RADIO DISTRIBUTING CO.
NEWARK, NEW JERSEY

This Mark RADIO·DISTRIBUTING·COMPANY· RADISCO ·APPARATUS· *Your Guarantee*



THE RADIO DEALERS listed below are progressive merchants. They are equipped to give you helpful advice and real service in selecting your radio equipment. As an indication of their up-to-date methods, they carry a complete line of Radisco apparatus, including the new vario-coupler, Radisco Coils, Better "B" Batteries, Corwin Dials, etc. Buy from the nearest Radisco agency, and be *sure* of satisfaction.

ALBANY, N. Y.
Shotton Radio Mfg. Co.
8 Market St.

ASHEVILLE, N. C.
Hi-Grade Wireless Instrument Co.

ATLANTIC CITY, N. J.
Paramount Radio Supply
Arkansas & Pacific Aves.

BOSTON, MASS.
Atlantic Radio Co.
727 Boylston St.

BROOKLYN, N. Y.
Kelly & Phillips
312 Flatbush Ave.

EUREKA, ILL.
Klaus Radio Co.

KANSAS CITY, MO.
McCreary Radio Supply
4th and Delaware Sts.

McKEESPORT, PA.
K & L Electric Co.
427 Olive St.

NEWARK, N. J.
A. H. Corwin & Co.
4 West Park St.

NEW ORLEANS, LA.
Rose Radio Supply
604 Gravier St.

OMAHA, NEBRASKA.
O. B. Radio Supply Co.
406 Brown Building.

NEW BRUNSWICK, N. J.
Geo. N DeLaplaine
306 George St. and
8th and Magnolia Sts.

PHILADELPHIA, PENN.
Philadelphia School of Wireless Telegraphy
1533 Pine St.

PITTSBURGH, PENN.
Radio Electric Co.
3807 Fifth Ave.

PLAINFIELD, N. J.
Paul R. Collier,
154 E. Front St.

PORTLAND, ME.
Atlantic Radio Co.
15 Temple St.

PROVIDENCE, R. I.
Rhode Island Electrical Equipment Co.
45 Washington St.

SCRANTON, PENN.
Shotton Radio Mfg. Co.
P. O. Box 3
Branch 8, Kingsbury St.
Jamestown, N. Y.

SEATTLE, WASH.
Northwest Radio Service
1637 Westlake Ave.

WASHINGTON, D. C.
Eastern Radio and Elec. Co., 1405 Florida Ave., N. W.

Canadian

MONTREAL, QUEBEC.
J. B. Miller
136 Vendome Ave.,
N. D. G.

TORONTO, ONTARIO.
The Vimy Supply Co.
567 College Street.

To Responsible Dealers: If you are in a town where there is no Radisco Agency, you will benefit by writing for the Radisco Plan.

RADISCO

"Your Assurance of Satisfactory Performance"

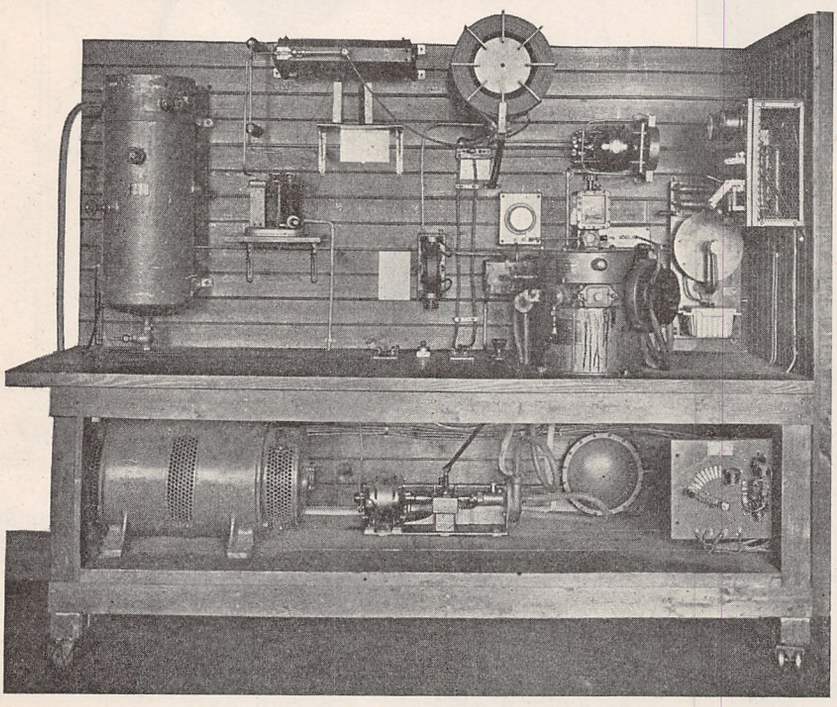
TEL. BACK BAY 5964

EASTERN RADIO INSTITUTE

899 BOYLSTON ST.
BOSTON, MASS.

SPARK--ARC--VACUUM TUBE

The Revised Examinations for Commercial Operators including ARC and VACUUM TUBE is carefully and fully covered by the Course of Instruction offered by the EASTERN RADIO INSTITUTE. Intelligent students INSIST on being taught upon ACTUAL apparatus!



"The EASTERN RADIO INSTITUTE'S 2 K.W. 'ARC' "

The EASTERN RADIO INSTITUTE is the OLDEST, LARGEST and BEST EQUIPPED Radio School in New England. The Pioneer school that has always led the way! Ask any man in Radio—he will tell you!

New Students can begin to advantage in the Day or evening school on any Monday.

REMEMBER:—Our ORGANIZATION with YEARS of PHENOMENAL EXPERIENCE and SUCCESS is behind every man who enrolls. Ask any man in Radio he will tell you! OVER 4000 satisfied graduates TELL OUR STORY BEST! Why not be one?

Our illustrated prospectus is free. If you cannot visit the Institute send for one.

F. D. PITTS, Director

Quality Radio Equipment

Doubleday-Hill "Federal" Headsets

Very efficient—light weight—highly sensitive. Will meet the most rigid requirements. Both receivers paired by test. Ability to bring in weak signals clearly make them very popular with experimenters.

2200 ohm D.-H. E. Co. "Federal" Headset $8.00

3200 ohm D.-H. E. Co. "Federal" Headset $10 50

Each complete with 6 ft. moisture-proof cord.

Distributors for Grebe, DeForest, Murdock, Signal, Chelsea, Magnavox and other highest grade Radio Apparatus. All sizes of Radiotron Vacuum Tubes always in stock.

Mail orders promptly filled — Dealers—Write for Discount

DOUBLEDAY-HILL ELECTRIC CO.

715 Twelfth St., N. W., Washington, D. C. *Radio Dept.—Desk B* 719-21 Liberty Ave., Pittsburgh, Pa.

2 BAK Tarrytown, N. Y.

(*Continued from page* 400)

The right top panel contains a special amplifying panel using a detector and one to five steps of amplification. A long wave of honeycomb coil receiver is to be mounted in the lower right hand, now blank, panel. All the panels are removable.

The antenna consists of two iron supports on which is supported a well insulated five-wire inverted L antenna 60 feet long. A counterpoise ground is used which is 40 feet below the antenna. It was noted that .4 more radiation was obtained using a counterpoise ground than the earth as a ground.

The set is radiating one ampere on 200 meters with 360 volts on the plate, taking 175 M.A., using radiotron 5 watt tubes.

Mr. Koenig is working out a C.W. transmitter that will work to good advantage on 200 meters; he is also working out a small arc type transmitter to work on 200 meters.

Let the Average Man Know

(*Continued from page* 386)

reau's Hall of Fame before the end of the year. That would be a good ad. for radio and mean more sales, but that is nothing compared with the satisfaction a real man feels in being responsible for the success of a real boy.

We need in radio a Mr. Vail, who will see that wireless can only become immensely big and profitable as it becomes a thing for the use of the average man. Not for occasional use like the telegraph or cable, not necessarily for private communication like the telephone, but for the reception of first-hand, authentic information from our Government and from all the world.

We cannot get the average man into radio without telling him how simple and easy it is to begin, and that it is not necessary for him ever to spend any more than he wants to. We must tell him that with a dollar's worth of apparatus he can hear at least one good station. If he lives out of range of a Government station, we must make good by relaying some good stuff to him. There is no great difficulty in that. Every local dealer ought to maintain a transmitting station and broadcast at least one or two messages a day for his customers to pick up. That is a unique sort of advertising which no other merchant can duplicate. Such broadcasts might tell whether the trains were on time and whether the car that was to receive the farmers' calves was on the siding.

Probably some radio advertisers think they have been talking to the average man. I suggest to them that they do what I did just now. I picked up several magazines—*The American*, *The Atlantic Monthly*, and RADIO NEWS—to see what their ads. said to the average man.

In RADIO NEWS there were 120 display ads., not including those which were not directly related to radio. Of these, 111 were technical, that is, they would have meant nothing to me as an average man before I found out that radio was useful to me. Six were school ads., leading the reader to believe that he must go away from home to take a course, or take a long technical correspondence course at home, and that the only object is to get a job somewhere, go into a new line. Two were book ads., giving the impression that much reading is necessary before the average man can use radio.

That was all, except one ad. offering a system for learning the International Morse Code, and that of course would appeal to the average man only after he had tackled radio.

$10 C-W COURSE FREE

Yes, it's true. Any amateur can now be an expert in C-W. You study the *same* **famous C.W.C.** course for which hundreds of operators have paid the regular price of $10.00, *absolutely FREE.* The future of wireless is C-W and without a clear understanding of this subject you are only an ordinary experimenter. Spark stations will soon be a thing of the past. What will you do then? This course teaches you and *we pay the cost.* Learn thoroughly this fascinating subject.

Be A Big Fellow in the C-W Game

No one wants to be a back number in the new science—WIRELESS TELEPHONY. You don't have to be. Study in Wireless is success. We as dealers in standard wireless apparatus of every description realize that the future of wireless depends on operators like you. For this reason we are glad to help you. This offer is not to be measured in dollars and cents. Our business is constantly growing and gifts are not necessary. We know, however, that this assistance will result in developing you and increasing the efficiency of your station.

Standard Apparatus At Standard Prices

There is nothing difficult about your apparatus order. You order standard equipment from any standard catalog printed, whether it be on the Pacific Coast, Gulf of Mexico or New England. Order any apparatus of any description. We have it. Every piece guaranteed to be new and mechanically perfect. *You pay no more* when you buy from us and the 10 complete C.W. Course Lessons are yours FREE.

Your Friends Can Help You Get This Course

If you cannot use $100 worth of radio apparatus all at once get your friends to send their orders along with yours. When you master this C.W. study your friends will be amazed at your knowledge. Be a leader. Repay them with advice for helping you get the course. Start now. *Don't delay.* This offer is limited. When it is over, the price will be $10 instead of FREE. Get busy *today* and send us your order.

How to Send Your Order

Use any standard catalog. Pick out the instruments you want. Send name, style, size (number if given), and manufacturers name of each. *Use same prices quoted.* When the total is $100 or over, send money or certified check to cover the amount. Your order is filled and sent, charges prepaid, and your course begins, the day we receive it.

KNOW!

These Subjects

Principles and Theory of C.W.—Best Results from Vacuum Tubes—Power of Any Kind Adapted to Any C.W. Set—Transmitting Circuits—How to Construct C.W. Set—Correct Values of Inductance, Capacity, Resistance, etc.—Greatest Radiation and Longest Range—Hundreds of Other Subjects Illustrated.

You Learn at *Our* Expense

RADIO EQUIPMENT CO.
630 Washington St.,
Boston, Mass.

To Our Regular Customers

With an added stock for this announcement we are better prepared than ever to fill your requirements for smaller radio orders. Our service is of established reputation. Order from any standard Radio catalog. Immediate shipments on guaranteed apparatus.

SPECIAL OFFER

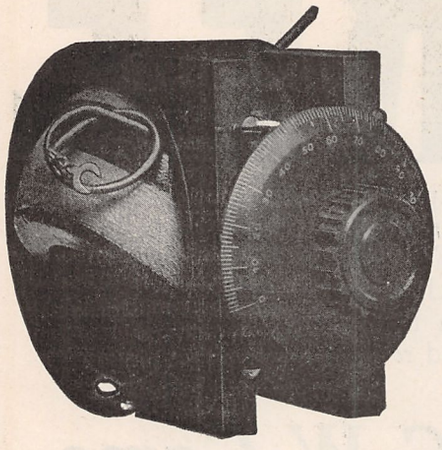
With every order amounting to $100 of standard radio equipment the Radio Equipment Co. will give ABSOLUTELY FREE 10 complete printed lessons in elementary and advanced C.W. This is the famous C.W.C. course which includes literature, bulletins, charts, diagrams and a free consulting bureau to all members. Course to be mailed to you as you progress. This is to be determined by written examinations taken at frequent intervals. There are no restrictions. The first lesson accompanies your order.

DO IT NOW!

Supply Limited

ORDER FROM ANY STANDARD CATALOG

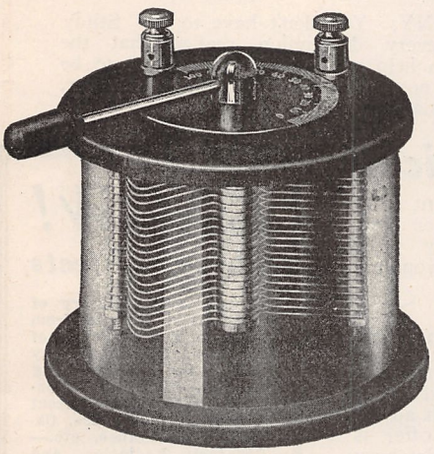
QUALITY CE SERVICE



We don't say that C.E. apparatus is the only good radio equipment you can buy. But we do say that every piece of equipment in the C.E. line is made not just to sell but to serve.

For instance, when you buy this Type Z.R.V. Variometer for $6.50 you know, of course, you are getting a variometer at a low price. But you can be sure—because it is a C.E. product—that this variometer at $6.50 will give you your full money's worth in satisfactory service. It affords a means of regulating inductance that you can depend on as permanently accurate. And its range of inductance is unusually wide—1.25 millihenry maximum to .1 millihenry minimum. Brush connections enable the rotor to be continuously rotated without breaking connection. Another thing, the outer portion of this C.E. Variometer is of unit construction, a feature that prevents the troubles due to misalignment of bearings which so often happens when the outer element is made in two parts. Furnished unmounted. Ready for use either on table or panel.

C. E. Variometer, Type Z.R.V. Complete $6.50. Without knob or dial $5.75.



Then there is this C.E. Rotary Variable Condenser. It is a fact that way back in 1908 we built and marketed the first rotary variable condenser in this country and have maintained leadership in high quality ever since. Note for instance these quality features of our C.E. Model 43 and 17 Rotary Variable Condensers: Aluminum plates accurately punched with hardened dies—far superior to condensers with trouble making plates containing iron and steel. Both rotary and stationary plates are spaced with separators machined to an accuracy of one two-thousandth of an inch. The rotary plates are carried on a shaft made of finest tool steel mounted in a long, accurately machined brass bearing insuring permanently accurate adjustment and long life. The entire Condenser is enclosed in a cylinder of the clearest and toughest flint glass and has a pressed metal base and a top of specially moulded insulating material highly polished. Readings are indicated on a black rotary dial with extension handle and sunken silver numerals and scale. Made in two sizes respectively equipped with 43 and 17 plates. The capacity of the 43-Plate Condenser is approximately .0008 M.F. and of the 17-Plate Condenser approximately .0003 M.F. The fine workmanship and superior materials put into this C.E. Condenser are apparent in its handsome appearance and efficient service. Yet it costs no more than many inferior condensers. We have never departed from our high standard to meet a price and will continue to supply our condensers as in the past with accurately machined individual separators, aluminum plates and all the other quality features which distinguish them. Lower manufacturing costs, however, enable us to offer this C.E. Rotary Variable Condenser at the new low prices quoted below.

C.E. Rotary Variable Condenser, 43-Plate ..$4.75 43-Plate, unmounted ...4.25 17-Plate ...$4.25 17-Plate, unmounted ...$3.25

Send 6 cents for the C.E. Catalog showing our full line of radio equipment—Hytone Transmitting Sets, Oscillation Transformer, Regenerative Receiving Sets, Radio Telephone Receiving Set, Two-Stage Amplifier, Wavemeter, Tesla Coils, Spark Dischargers, Keys, Instruments, etc., etc.

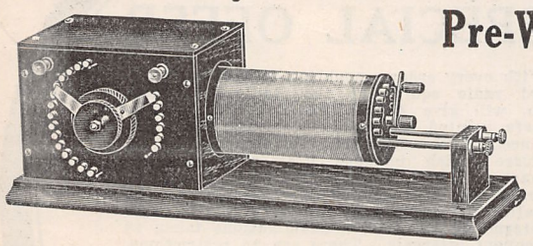
CLAPP-EASTHAM COMPANY

RADIO ENGINEERS *and* MANUFACTURERS

120 Main Street CAMBRIDGE, MASS.

California Representative:
LEO J. MEYBERG CO., SAN FRANCISCO AND LOS ANGELES 127-5

Arnold Navy Model Loose Coupler Back to Pre-War Price, $15.00



The most consistent piece of Radio Apparatus to hear the Wireless Telephone on without distortion.

Range from 200 to 3000 Meters.

AMATEURS, COMMERCIAL AND ARLINGTON

use this Loose Coupler and the Arnold Audion Detector which sells complete with Batteries and Bulbs for $20 if you want results. But you must buy from the manufacturers to get these prices.

Order today. Prompt shipment promised or send 3c stamp for Catalogue.

J. F. ARNOLD, 2082 Lexington Ave., NEW YORK

ESTABLISHED 1910

FREE TO MANUFACTURERS AND DEALERS —A BEAUTIFUL DISPLAY PANEL

Showing our line of BINDING POSTS, SWITCH POINTS, ETC. Not only a guide in buying but a valuable selling aid. Write for particulars.

AMATEURS, EXPERIMENTERS. Get our retail illustrated price-list. No charge.

PREMIER DENTAL MFG. CO. Screw machine products **60 N. 2d St., PHILA., PA.**

There was a sensible little ad. offering a low-priced outfit to Boy Scouts, but it omitted the chief argument in favor of a Boy Scout's having a radio set, which is that the United States Navy expects him to be the connecting link between the Navy radio stations and average folks, until radio sets become household utilities, the same as stove shakers.

This advertising is all right for a technical magazine and for the man who knows enough about radio to grasp what we are talking about, but if we stop there, who is going to start the fellows who look at the word "Radio" and sagely explain to their best girls that that is the stuff that French woman Whatsername discovered?

Editorially, RADIO NEWS is much better adapted to the task of getting people interested in radio. Its articles for beginners are ideal to place in the hands of a man when he purchases his first outfit and begins to listen in. Dealers ought to reprint them and distribute them at cost or less.

The *American Magazine*, built for the average man, had not one radio ad. The ads. which it did carry afford some interesting comparisons. They left out technical details and made things simple and easy. For example, there was a revolver ad. Did it explain the relation between the pressure created by the exploding powder and the strength of the steel in the barrel? Or trace the trajectory of a bullet from the muzzle to its mark? It did not! It just showed a picture of a man who had been robbed and tied up. It makes the average man feel that the same thing is likely to happen to him any day and that he must have a gun. It ignores the fact that, (if I have counted the incidents correctly) for every man who beats the crooks on the trigger at the crucial moment, there are two whose children kill somebody by fishing loaded weapons out of the bottoms of bureau drawers. The revolver ad. writer capitalizes the very occasional incident far more cleverly, while the radio ad. man omits the big fact that radio contributes to the family welfare every day.

Along with the fact that there was no radio advertising in the *American* goes the fact that it has a story in the same issue by a writer who tells the world that "QST" means: "Have you anything for me?" It is a very little mistake in a corking good story which will give radio a big boost and I mention it only to make this point: that if the radio advertisers had been on the job, the one little mistake, which makes the radio man smile and the editor and writer sorry, would not have happened. The story, instead of being only an interview with a big man who specializes in radio might just as well have had the added punch of the personal experience of the writer in listening to QST's.

Could radio advertisers do anything better for the business than to get writers and editors—average men from the radio standpoint, though they may be distinguished in their respective professions—to sit down for an hour at least with the phones on their heads and the Bureau of Commerce "Q Signal" card pinned to the wall, and hear what the average man may hear and enjoy?

In the *Atlantic Monthly* a woman told the most remarkable radio experience I have ever read. She said that in Washington she sat down at a radio receiver, brought in various arc stations and combined their notes to make harmonies. She did not say that they played tunes for her, but I received the impression that they made chords and everything.

Well, maybe she did. I am always willing to give a lady the benefit of a doubt. But having myself brought in NSS on 14,000, WSO on 11,650, NFF on 13,600, NWW on 9,200, and various other C.W. stations on waves all the way from 2,500 up, I am driven to the conclusion that if she did the stunt—getting them all at once

(*Continued on page 424*)

A DEPENDABLE RADIO TELEPHONE

For the Amateur

Here is the Complete Circuit—it Works—

Look over our New Catalog, Select the Necessary Apparatus and Order it from your Nearest Dealer

Radiotron Transmission combined with Kenotron Rectification and Magnetic Modulation constitutes the ideal amateur set

ANTENNA SERIES CONDENSER
UC-1015
Price $5.40

OSCILLATION TRANSFORMER
UL-1008
Price $11.00

TRANSMITTER GRID LEAK
UP-1719
Price $1.10

GRID CONDENSER
UC-1014
Price $2.00

RADIOTRON POWER TUBES
UV-202
5 watt output
Price $8.00
(One or two may be used)

MAGNETIC MODULATOR
UP-1346
Price $9.50

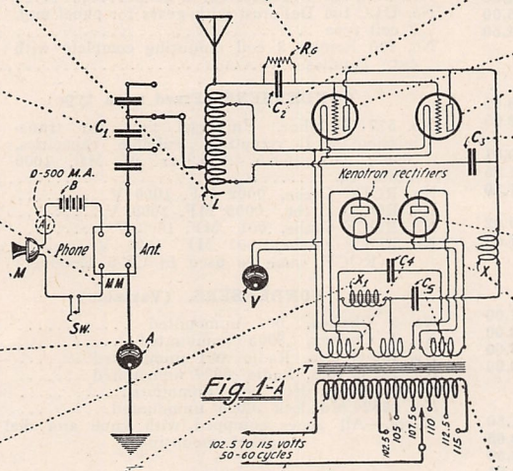


Fig. 1-A

BLOCKING CONDENSER
UC-1014
Price $2.00

ANTENNA AMMETER
UM-530
Price $6.00

KENOTRON
Rectifier Tubes
UV-216
Price $7.50 each

FILTER REACTOR
UP-1626
Price $11.50

POWER TRANSFORMER
UP-1368
Price $25.00

FILTER CONDENSER
UC-1631
Price $1.35

FILTER CONDENSER
UC-1632
Price $1.35

RADIO FREQUENCY CHOKE
See page 15 of our catalog for complete how-to-make-it instructions.

The above circuit diagram is but one of many appearing in our new Catalog where the necessary apparatus for each circuit is clearly and accurately described. By following the advice given therein and purchasing the leading items listed, the amateur is assured of the maximum efficiency at a minimum of power consumption. And remember, that the new Magnetic Modulator makes the operation of a radio telephone set exceedingly simple.

If you live in the United States and have not already secured your copy of our combined instruction book and catalog, send 25 cents today to

SALES DIVISION, Suite 1802

Radio Corporation of America

WORLD WIDE WIRELESS

233 BROADWAY—NEW YORK CITY

RADIO A

"PITTSCO SERVICE" SPECIALIZING ON "GREBE RADIO"

TRY US AND SEE

DISTRIBUTORS OF RELIABLE RA SCHOOLS, COLLEGES, RADIO ALL OVER

AMPLIFIERS

No. DA Westinghouse, detector and two stage in mahogany cabinet	$65.00
No. RORK Grebe, two stage with automatic filament control, a beauty	55.00
No. RORD Grebe, Det. and two stage with automatic filament control	75.00
No. Y-2 Acme, one stage in cabinet	13.00
No. 331 Remler, amplifier panel, less transformer	6.00

AMPLIFYING TRANSFORMERS

No. UV-712 Radio Corporation	7.00
No. QO Clapp-Eastham, semi-mtd.	4.00
No. P-1 Saco-clad, shielded type	5.00
No. 50 Chelsea, just out	4.50

ANTENNA WIRE

"Pittsco" No. 14 hard drawn copper (80 ft. per lb.) Per lb.	0.40
500 ft. special value at	2.25
"Pittsco" 7 strand No. 22 tinned copper (65 ft. per lb.) Per ft.	0.01
500 ft.	4.25
1000 ft. special value at	7.50
"Pittsco" 7 strand No. 20 phosphor-bronze, per ft.	0.02
500 ft. special value at	7.50

AUDION CONTROL PANELS

No. RORH Grebe in cabinet with tickler connections, hinged cover	17.00
No. 330 Remler with "A" Battery potentiometer	8.00
No. 70 Paragon, moulded type	6.00
No. Y-1 Acme, in cabinet	10.00

"B" BATTERIES

No. 7623 Standard 22.5 V. small	1.50
No. 7625 Standard 22.5 large	2.65
No. 7650 Standard 22.5 V variable	3.50
No. 763 Eveready 22.5 V. small	2.25
No. 766 Eveready 22.5 V. large, 16½ to 22½ v.	3.00
No. 627 Ace 45 volts, variable, block type	3.50

BOOKS

Practical Wireless Tel., by Bucher	2.25
Wireless Experimenters Manual, by Bucher	2.25
Vacuum Tubes in Wireless Communicaton, by Bucher	2.25
Radio Telephony, by Goldsmith	2.50
Robinson's Manual of Wireless Tel. by Lt.-Robinson, U. S. Navy	2.50
How to Pass U. S. Govt. Exams., by Bucher	0.75
Practical Amateur Stations, by Bucher	0.75
How to Conduct a Radio Club, by Bucher	0.75
Radio Corporation's "C.W. Instruction," just out!	0.25

(Any of above books make ideal Xmas gifts)

BUZZERS

No. 77 Mesco high frequency	2.50
No. 168 Century high frequency	2.50
No. 170A General Radio high frequency	2.00

CHOKE COILS

Acme single coil, 1.5 Hen. 150 M. A.	4.00
Acme double coil, 1.5 Hen. 150 M. A.	6.00
Acme single coil, 1.5 Hen. 500 M. A.	6.00
Acme double coil, 1.5 Hen. 500 M. A.	8.00

COILS (Duo-lateral)

Note: Lower prices!

DL-25	$1.40	DL-300	1.75
DL-35	1.40	DL-400	1.80
DL-50	1.50	DL-500	2.00
DL-75	1.50	DL-600	2.15
DL-100	1.55	DL-750	2.35
DL-150	1.60	DL-1000	2.60
DL-200	1.65	DL-1250	3.00
DL-250	1.70	DL-1500	3.50

COIL MOUNTINGS

No. ULC-400 DeForest for 3 coils	5.30
No. ULC-100 DeForest with gears for panel mtg. 3 coil type	9.00
No. 400 Remler 3 coil mounting complete with ext. handles	6.50

CONDENSERS (Fixed mica type)

No. 577 Dubilier, Universal type for transmission and reception, suitable capacities, .0005, .001, .0025, .005, or .01 Mf., 1000 Volts ea.	2.00
No. ROCC Grebe, .0002 MF. 1000 V.	1.00
No. ROCD Grebe, .0005 MF. 1000 V.	1.20
No. ROCE Grebe, .001 MF. 1000 V.	1.60
No. ROCF Grebe, .005 MF. 1000 V.	3.50

(ROCF, same as used in CR-5 Receiver)

CONDENSERS, (Variable)

No. 3 Chelsea, .001 unmounted	4.75
No. 4 Chelsea, .0005 unmounted	4.25
No. 182-G Gen. Radio .001 unmounted	9.70
No. 182-C Gen. Radio .0007 unmounted	8.50
No. 3662 Murdock .001 unmounted	5.00
No. 3682 Murdock .0005 unmounted	4.25

(Note.—All above equipped with knob and dial for panel mounting)

CRYSTALS

No. P-1 Silicon, unmounted	0.25
No. P-2 Galena, unmounted	0.25
No. P-3 Silicon in Wood's metal	0.50
No. P-4 Galena in Wood's Metal	0.50
No. P-5 Radiocite, unmounted	0.40
No. P-6 Wood's metal, only	0.25

CRYSTAL DETECTORS

No. RPDB Grebe, dustproof	2.75
No. D-101 DeForest, dustproof	2.60
No. 8854 Jove	1.70
No. 324 Murdock	0.70

C. W. INDUCTANCES

No. UL-1008 Radio Corporation, just out	11.00
No. P-1 Acme	8.00
No. 181 Tuska, Cap. Feed-back circuit	7.50

C. W. POWER TRANSFORMERS

Acme 50 Watt 350 volts, mounted	15.00
Acme 50 Watt 350 volts, unmounted	12.00
Acme 200 Watt 350-550 V. mounted	20.00
Acme 200 Watt 350-550 V. unmounted	15.00
Acme 500 Watt 1000-1500 V. mounted	25.00
Acme 500 Watt 1000-1500 V. unmounted	20.00

SEND US YOUR ORDERS TODAY!

DIALS

Type P-1 Somerville Dial Indicator	$2.00
Type P-2 Tuska, ¼" or 3/16" shaft	1.50
Type P-3 Chelsea, ¼" or 3/16" shaft	1.00
Type P-4 Remler ¼" or 3/16" complete	1.00

FILAMENT HEATING TRANSFORMERS

Acme 75 Watt, mounted	12.00
Acme 75 Watt, unmounted	9.00
Acme 150 Watt, mounted	16.00
Acme 150 Watt, unmounted	13.00

FILTERS

No. 170 Tuska, in cabinet	16.00

FILTER CONDENSERS

No. 21AA Western Electric, 1000 Volts	2.50
No. "73" Radio-Electric 1 MF 1500 Volts, puncture-proof	4.00
No. "73" Radio-Electric 2 MF 1500 volts, puncture-proof	5.00

GRID LEAKS

No. UP-516 Radio Corp., ½, 1, 1.5, 2, 2.5, or 3 megohms, each, complete	1.25
Grid leaks, only	0.75
Bases only	0.50
No. 96 Remler, adjustable type	0.60
No. 21 Chelsea, variable, 10 values	3.00

GROUND EQUIPMENT

No. P-1 100 Amp. 600 Volt, ground switch, special value at	3.75
No. P-2 Ground wire, No. 4 weatherproof, per ft.	0.06
No. P-3 "Pittsco" ground clamp	0.20

HOT WIRE METERS

No. P-1 Roller-Smith, 0-2.5 flush mtg., real value at	4.75
No. 127 General Radio, .5, 1, 2.5, 5 or 10 amperes, flush or front of board, ea.	7.75

INSULATORS

No. P-1 Electrose Ball insulator	0.35
No. P-2 Electrose 4" insulator	0.45
No. P-3 Electrose 10" insulator	0.75
No. P-4 Electrose 15⅞" insulator	1.50

JACKS

No. 1421-W Federal open circuit	0.70
No. 1422-W Federal closed circuit	0.85

SEND US YOUR

LET "PITTSCO" PRODUCTS, SUPERSERVICE A

"PITTSCO SERVICE REACHES ALL OVER THE

12 PARK SQUARE, Dept. 207 F. D. PITT

PPARATUS

ADIO APPARATUS TO DEALERS, CLUBS AND EXPERIMENTERS THE WORLD!

"PITTSCO SERVICE" SPECIALIZING ON "RADIO CORPORATION'S" PRODUCTS SEND US YOUR ORDERS

PLACE YOUR XMAS ORDERS NOW!

No. 1423-W Federal 2 circuit 1.00
No. 1435-W Federal automatic fil. control 1.20
No. 1438-W Federal automatic fil. control 1.50

KEYS

No. 8650 Mascot, brass, up to ½ K.W. 3.00
No. 7943 Beeko, practice type 1.40
No. F-643 Clapp Eastham 10 Amperes 7.50
No. 285 Murdock strap-key 0.70

LOOSE COUPLERS

No. A-1 Arnold, 3500 meter type 20.00
No. F-673 Clapp-Eastham, 3000 meters 14.00
No. 344 Murdock, 1500 meters 9.00

LOUD SPEAKERS

No. R-3 Radio Magnavox, latest model 45.00
No. P-2 Vocaloud, station type 30.00
No. 400-W Federal "Pleiophone" 14.00

METERS

Model 301 Weston, D. C. flush, 0-100, 0-150, 0-200, 0-300, 0-500, 0-800 milli-amperes, each 8.50
Model 301 Weston, D. C. flush, 0-1, 0-2, 0-3, 0-5, 0-10 amperes, each 8.50
Model 425 Weston, flush, Thermo-ammeter, 0-1, 0-2.5, 0-5, each 18.25
No. P-1 Jewel, A. C. flush 0-15 voltmeter; ideal for power bulbs 8.00

MICROPHONE TRANSMITTERS

No. 5176-A Conn. with Adj. arm 4.00
No. HM-100 De Forest hand type 6.00
No. 260-W Federal Hand type 7.00
No. R-1 Magnavox hand transmitter 25.50

MODULATION TRANSFORMERS

No. A-3 Acme semi-mtd' 5.00
No. A-3 Acme fully mounted 7.00
No. 231 General Radio, new type 5.00

MOTORS

Amrad, synchronous, ¼ H.P. frame 25.00
Wagner, induction, ¼ H.P. 1750 R.P.M. 110 Volts 25.00

OMNIGRAPHS

No. 2 Omnigraph, 15 dial type 30.00
No. 2 Jr. Omnigraph 5 dial type 22.00
No. 5 Omnigraph 1 dial type 14.00
Set of 15 Continental dials 4.00

PLUGS

No. 50 Pacent universal type 2.00
No. 1428-W Federal brass 2.00
No. 1428-W Federal silver-plated 2.50

PLUGS (Bakelite)

No. 40 Remler bakelite coil plug 0.65
No. 41 Remler bakelite panel plug, stationary type 0.65
No. 43 Remler bakelite coupling plug 1.10
No. 45 Remler 14" fiberoid strap for coils, each 0.15

POTENTIOMETERS

No. PR-536 Radio Corp. "A" Bat. type 2.00
No. 93 Remler "A" Bat. type 0.75
No. F743 Clapp Eastham 5000 ohms, "B" battery type 3.00

RECEIVING SETS (Crystal)

Westinghouse, "Aeriola" with Brandes "Superior" phones 25.00
Radio Service, Type S-8 without phones 7.50
Amrad, latest model 20.00

RECTIFYING DEVICES

No. UV-216 Radio Corp. "Kenotron" 20 Watt type for UV-202 tubes 7.50
No. UV-217 Radio Corp. "Kenotron" 150 Watt type for UV-203 tubes 26.50
No. P-1 De Forest 20 Watt Rectifying tube for use with 5 watt tubes 7.00

RECTIFYING DEVICES (for "A" Batteries)

No. P-1 Tungar, 5 ampere type, complete with Bulb 28.00
No. P-2 Tungar, 2 ampere type with bulb 18.00
No. P-3 FF Battery Booster, 5 amp. type 15.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe "Relay-Special" 175-680 meters 65.00
No. CR-3A Grebe 175-375 meters, complete set, ideal for radiophones 35.95
No. CR-3A Grebe, same as above, but knock-down, ready to assemble, an exceptional value at 19.95
No. CR-5 Grebe 175-3000 meters, "Super-special" complete set 80.00
No. CR-8 Grebe 175-1000 meters, complete set, latest "Relay special" 80.00
No. CR-9 Grebe 175-3000 meters, complete set with det. and 2 stage amplifier self contained, "A Masterpiece" 130.00
No. RA Westinghouse, 180-700 meters, very selective, mahogany cabinet 65.00
No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, compact 125.00

RESISTANCES (C W. Type)

No. UP-1719 Radio Corp. 5000 ohms, mid-tap 2500 ohms, for 5 watt tubes 1.10
No. UP-1718 Radio Corp. 5000 ohms, mid-tap 2500 ohms, for 50 or 250 watt tubes 1.65

RHEOSTATS

No. PR-535 Radio Corp., for use with the UV-200, UV-201 and UV-202 tubes 3.00
No. 214 General Radio 2.5 Amp. type 2.50
No. 90-P Shramco 6 Amp. type, just right for 1 UV-203 50 watt tube 2.00
No. 560 Murdock, panel mtg. new type 1.00
No. 810 Remler, Junior 1.00
No. 811 Remler, 1.5 Ampere type 1.75
No. 813 Remler, 3 Ampere type 1.75

SOCKETS

No. UP-552 Radio Corp. Bakelite type for UV-200, UV-201 and UV-202 tubes 1.50
No. UT-541 Radio Corp. Porcelain type for UV-203 50 Watt tubes 2.50
No. 156 General Radio, new price 1.50
No. 92 Remler, moulded 1.50
No. 550 Murdock, moulded 1.00

TELEPHONES

No. 56 Murdock 2000 ohm double 5.00
No. 56 Murdock 3000 ohm double 6.00
No. CW-834 Western Electric 2200 ohms 15.00
Brandes, "Superior" with new headband 8.00
Brandes "Trans-Atlantics" with new headband 12.00
Brandes, "Navy Type" with new headband 14.00
Baldwin's Type C 13.75
Baldwin's Type E 15.00
Baldwin's Type F 16.25
Baldwin's Type C unit only 6.90
Federal A. and N. Type 2200 ohms 8.00
Federal A. and N. Type 3200 ohms 10.50

VACUUM TUBES

No. UV-200 Radiotron detector 5.00
No. UV-201 Radiotron amplifier 6.50
No. UV-202 Radiotron 5 watt 8.00
No. UV 203 Radiotron 50 watt 30.00
No. UV-204 Radiotron 250 watt 110.00
Note:—All Radiotrons sent postage and insurance prepaid anywhere in U. S. A. Send us your orders for Radiotrons.

VARIOMETERS

No. 500 Remler Bakelite moulded 6.00
No. 501 Remler with knob and dial 7.00
No. 502 Remler panel mounted type 9.75
No. ZRV Clapp Eastham with dial 6.50
No. 200 Tuska, moulded 6.25
No. 200-A Tuska, moulded, with dial 7.25
No. 2606 Amrad, with knob and dial 6.75
No. 2606 Amrad, new type, just out 6.10

VARIO-COUPLERS

No. 503 Remler 180 type 5.40
No. 504 Remler with knob and dial 6.40
No. 505 Remler panel mounted type with knob and dial 12.75
No. 201 Tuska moulded 7.50
No. 201-A Tuska moulded, with dial 8.50
No. ZRV-Clapp-Eastham, with dial 7.50
No. ZRV-Clapp-Eastham, with dial and switch-arm, points and stops 9.00
No. 2613 Amrad, new type, just out 6.25
No. 2613 Amrad, with knob and dial 6.90

ORDERS TODAY!

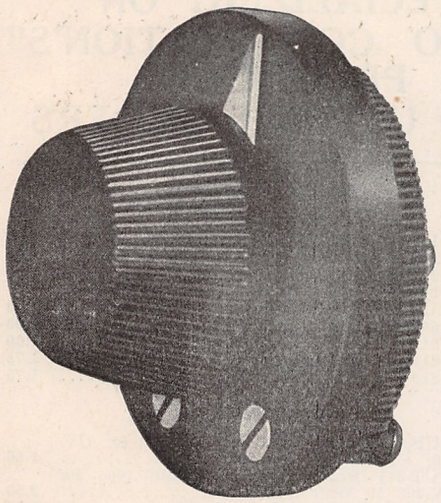
AND **DELIVERY** SOLVE YOUR **XMAS** PROBLEMS!

E WORLD! WHY NOT LET IT REACH YOU!"

TS CO., Inc. BOSTON MASS., U. S. A.

A BEAUTIFUL CATALOG OF FADA EQUIPMENT

has just been published and will be mailed to you upon receipt of ten cents to cover mailing. It describes and illustrates all FADA instruments and parts. You should have a copy of this catalog before you purchase another single radio part or supply. It will show you how to save money and get more satisfaction from your investment. Write for IT.



Showng the Thermoplax knob used on the FADA rheostat.

FOR YOUR RECEIVING TUBES

use the FADA panel mounting rheostat pictured at the left. It has a resistance of 6 ohms and a current carrying capacity of 1½ amperes. Thousands of these rheostats are being used to-day to control the filament current of all sorts of vacuum tubes and every one is proof that they are giving satisfactory service.

Production on rheostats has been doubled the last month, a few improvements added and the cost reduced. At $1.00 each, they are the best rheostat obtainable.

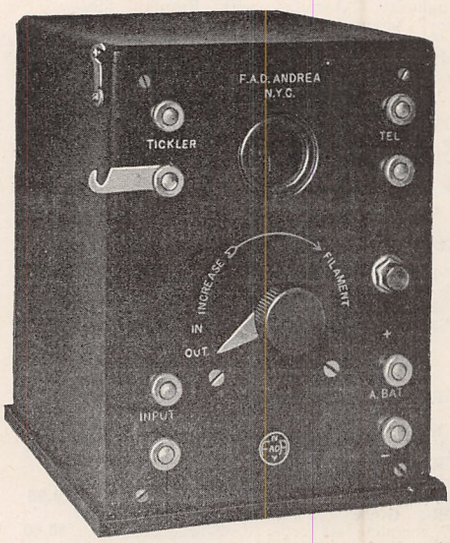
The base of the rheostat is made of Thermoplax, which is a synthetic-asbestos material that will stand heat up to 600 F. Into this base is set the resistor strip. The resistance wire itself is most carefully wound, so that the phosphor bronze contact brush can make smooth contact to each turn. The movement of the contact brush over the resistance wire is thus very smooth, allowing critical adjustments to be made.

Each rheostat is now furnished with the new FADA Thermoplax knob, and with a pointer having a radius of 1". Two flat head machine screws are supplied to mount the rheostat to your panel.

FADA RHEOSTAT, each $1.00

DETECTOR --- AMPLIFIERS

In addition to the complete line of radio parts manufactured, the FADA detector and amplifier control cabinets are made. These instruments are made with the utmost care and attention is given in every detail. Only the very best materials are used and practically every instrument is made under the personal supervision of Mr. Andrea. Electrically, they embody the most modern engineering features. Transformers having the correct impedance ratios, automatic filament control, and wiring that eliminates "howling" due to resonant feed-backs, these are important advantages.



These four instruments can be supplied:

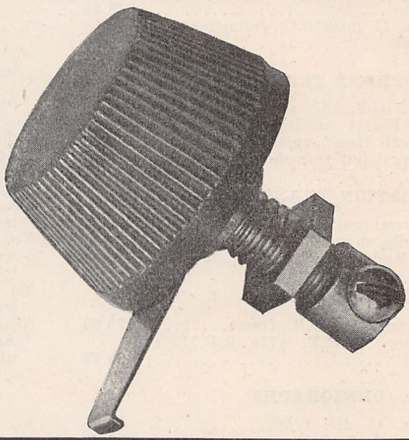
DETECTOR CONTROL PANEL $16.50
DETECTOR AND ONE-STAGE AMPLIFIER $45.00
DETECTOR AND TWO-STAGE AMPLIFIER $65.00
TWO-STAGE AMPLIFIER $50.00

INDUCTANCE SWITCH

The inductance switch pictured below is something new, better, and you pay less for it than for other inferior ones. Because of correct design it is easy to fasten to your panel and has a solid yet easy and smooth movement.

The panel bushing is made to fit into a 5/16" hole. Switch blade is made of spring phosphor bronze with a radius of 1¼". Blade highly nickel plated and polished. Other metal parts white nickel. The new FADA conical Thermoplax knob is used.

INDUCTANCE SWITCH each . $0.50
INDUCTANCE SWITCH complete with 8 switch points and two stops . . $0.75



THESE DEALERS RECOMMEND AND SELL FADA

ASBURY PARK, N. J.
VanDyke Electrical Co.
ATLANTA, GEORGIA
Carter Electric Co.
BOSTON, MASS.
F. D. Pitts Co.
Teco Radio Co.
Somerville Radio Lab.
BRADDOCK, PA.
United Electric Stores
BROOKLYN, N Y.
Kelly & Phillips Co.
Chas. G. Rosewall
CANTON, OHIO
Wireless Mfg. Co.
CHICAGO, ILL.
Chicago Radio Apparatus
Independent Radio Supply
Manhattan Electrical Co.
CINCINNATI, OHIO
Cino Radio Mfg. Co.
Midwest Radio Co.
HARTFORD, CONN.
C. D. Tuska Co.
HUDSON, N. Y.
White Electric Service
KANSAS CITY, MO.
McCreary Radio Supply
LANCASTER, PA
Lancaster Electric Supply
MELBOURNE, AUSTRALIA
P. H. McElroy
NEWARK, N. J.
L. Bamberger & Co.
Radio Distributing Co.
NEW YORK CITY, N. Y.
American Electro Technical Co.
Bronx Radio Equipment Co.
Continental Radio & Elec. Co.

FADA SUPPLIES WILL SOLVE YOUR CONSTRUCTION PROBLEMS

FOR YOUR 5 WATT POWER TUBES

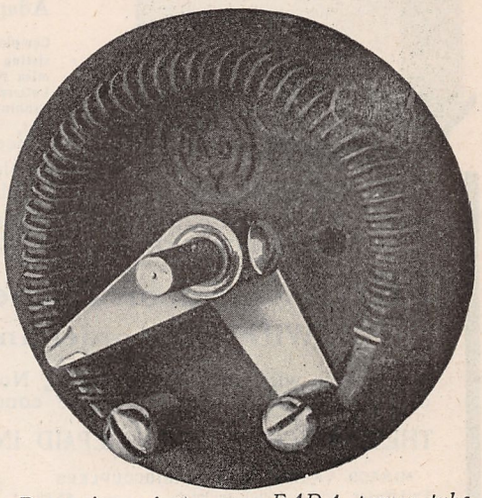
the most economical rheostat you can buy that will stand the current and heat is the FADA power rheostat, the rear view of which is shown at the right.

Better than I can tell you, the illustration shows the heavy Nichrome wire used for the resistance. This wire is tightly wound on a special horn fibre strip that itself will not be injured by a heat of 600 F. By inserting this resistance unit into our regular heat resisting Thermoplax base and by using the new FADA heat-resisting Thermoplax knob a power rheostat has been produced that really will "stand the gaff" and it costs you only $1.35 each, instead of $2.00, $2.50 and $3.00.

Its small size also is a good feature. The base overall is only 2⅛" in diameter. The pointer used has a radius of 1".

Very severe tests have been given this rheostat, beginning with a load of two Radiotron UV-202 tubes drawing 4.7 amperes. Overloads up to nearly 7 amperes have been carried for a short time, so we feel more than justified to recommend this rheostat for use with two 5 watt power tubes. The resistance is 1½ ohms.

FADA POWER TUBE RHEOSTAT, each $1.35



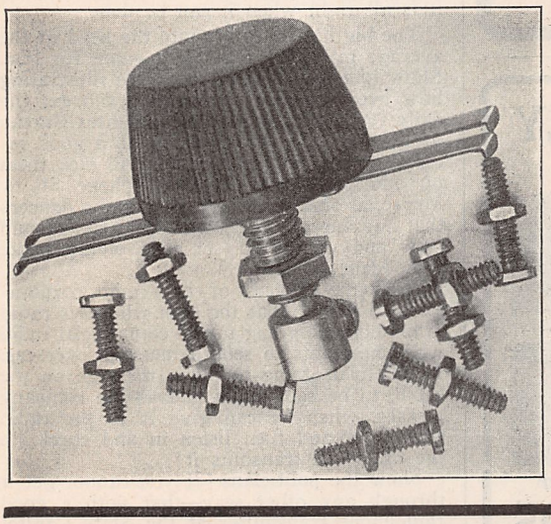
Rear view of the new FADA power tube rheostat showing the heavy Nichrome wire used.

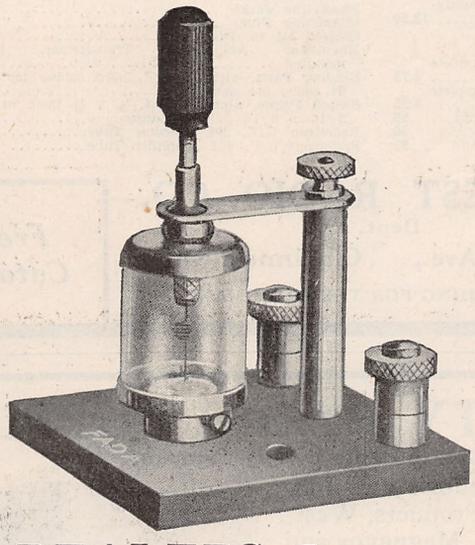
SERIES-PARALLEL SWITCH

This switch matches up wth the new FADA inductance switch, in that the new FADA conical knob is used. Radius of blades 1¼". Blades are nickel-plated and polished, all other metal parts white nickel.

SERIES-PARALLEL SWITCH, each . $0.75

SERIES-PARALLEL SWITCH complete with 8 switch points and 2 stops . . . $1.00





CRYSTAL DETECTOR

Crystal detectors are used to-day more than ever. Probably more FADA detectors are in use than any other kind. With the FADA crystal detector, signals, including radiophone speech and music, can be readily received.

Twice, the number of detectors that we make on one job lot has been increased. The first time the price was reduced from $3.00 to $2.50. This month the price is again reduced to $2.25 each. For such a detector as the FADA, with the Bakelite base, beautiful finish and super-sensitive galena crystal, $2.25 is a mighty reasonable price. Can you imagine a more appropriate Christmas present for the beginner than a loose coupler, pair of phones and a FADA Crystal Detector?

CRYSTAL DETECTOR, each $2.25

DEALERS Every recognized electrical and radio supply dealer is requested to write for the new dealers catalog of FADA products.

FRANK A. D. ANDREA

Manufacturer of **FADA** Radio Equipment

1882-A JEROME AVE. NEW YORK CITY

INSTRUMENTS AND SUPPLIES —

Dreyfuss Sales Corporation
Electro Importing Co.
Empire Radio Equipment Co.
David Killoch Co.
Manhattan Electrical Co.
Mutual Purchasers Assn.
Professional Radio Assembly
Ship Owners Radio Service, Inc.

PHILADELPHIA, PA.
Philadelphia Wireless School
Quaker Light Supply Co.
Sayre-Level Radio Co.
Simplex Radio Co.
Frank H. Stewart Elect. Co.

PITTSBURGH, PA.
Doubleday-Hill Electric Co.
Radio Electric Co.
Scheib Electric Radio Co.

PORT ARTHUR, TEXAS
Port Arthur Radio Lab.

SEATTLE, WASH.
Northwest Radio Service Co.

SHELTON, CONN.
Ark Radio Supply

ST. LOUIS, MO.
The Benwood Co.

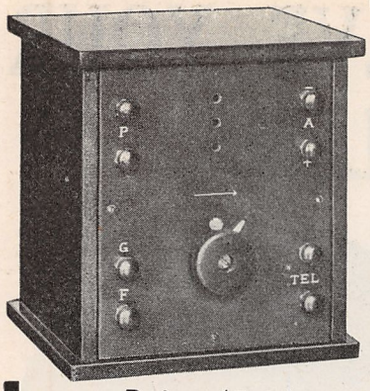
SYRACUSE, N. Y.
Hughes Elect. Corporation

TRENTON, N. J.
F. S. Katzenbach & Co.

WACO, TEXAS
Waco Elect. Supply Co.

WASHINGTON, D. C.
Continental Electrical Supply
Radio Instrument Co.

WILKINSBURG, PA.
The Electric Craft Shop



Price $7.85

PARCEL POST PREPAID IN U.S.A.
IMMEDIATE SHIPMENT

Start This Season Right

Use one of our "Miraco" type MW-8 Vacuum Tube Detector Units. Hundreds now in use. Best appearing and highest type unit at the price in the market. Adaptable to any modern hook-up.

Complete equipment consisting of a grained Formica Panel, 5¾ x 6 inches. Lettered in white, smooth-running rheostat; tube socket (4 prong) accurate grid condenser and grid leak and all necessary binding posts; is enclosed in a hinged top cabinet with space for "B" battery.

Price less "B" Battery and tube.. $7.85
With Variable "B" Battery, less tube 9.45
With "B" Battery and U.V. 200 tube 14.45

FREE Grid or Phone Condenser FREE

With every order amounting to $2.00

or over we will give FREE, during November and December, your choice of either a tested grid or phone condenser. Mail us your orders now.

THESE SPECIALS SENT PREPAID IN U. S. A.—IMMEDIATE DELIVERY

MIRACO VARIOMETERS—VARIOCOUPLERS

Variometer, without dial or knob.....$5.00
Variometer, with dial and knob.....6.00
Variocoupler, without dial or knob.....4.00
Variocoupler, with dial and knob..... 5.00

HEADSETS

No. 55 Murdock 2000 ohm receivers, double.. 4.50
Type "C" Baldwin Mica Diaphragm amplifying receivers, double 13.50

CONDENSERS

No. 3 Chelsea Variable .0011 mfd. complete with knob and dial for panel mtg..... 4.75
No. 4 Chelsea Variable .0006 mfd. complete with knob and dial for panel mtg..... 4.25
No. M126 Tested Grid Condenser .0005 mfd... .35
No. M127 Tested Grid Leak Condenser..... .50
No. M128 Tested Phone Condenser .001 mfd... .35

PLATE BATTERIES

No. 623 Ace 22½ volt "B" battery without taps $1.25
No. 623 Ace 22½ volt "B" battery with 6 taps 1.50

DETECTOR AND AMPLIFIER EQUIPMENT

Tube Socket, Murdock moulded 1.00
FADA Rheostat (new type) for panel mounting, reduced to 1.00
Rhamstine Jacks ..... .75
Rhamstine Plugs ..... .75
Chelsea 3¼ in. Dial..... 1.00
Rhamstine Amplifying Transformer, fully mounted 3.50
Binding Posts, nickel plated, hard rubber top, 9c each; per dozen..... 1.00
Switch Points, nickel plated, ¼ x ¼ inch. or 3/16 x 3/16 in.; per dozen..... .37
Radiotron U.V. 200 Detector Tube..... 5.00
Radiotron U.V. 201 Amplifier Tube..... 6.50

Free Catalog

MIDWEST RADIO CO.

Dept. A
3423 Dury Ave., Cincinnati, Ohio
"EVERYTHING FOR THE RADIOMAN"

Free Catalog

KANSAS CITY RADIO SUPPLY

Formerly McGreary Radio Supply Company

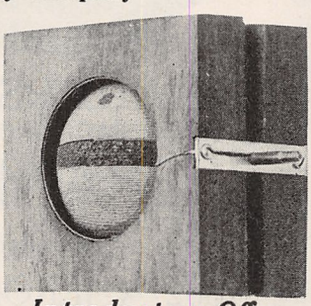
Authorized Central Distributors and Jobbers of Radio Corporation Products, Westinghouse Regenerative Sets, Magnavox and Radio Magnavox Apparatus, and Burgess Batteries. Reputable Dealers—We Can Supply You at Standard Discounts.

Quick Service on Radio Supplies

Write for Price Lists. We can fill all your Radio Needs Direct from Kansas City. Prices Right. Listen for our Radio Phone Bulletins and Concerts nightly from 8 to 11 o'clock.

SPECIAL BARGAINS IN VARIOMETERS AND VARIOCOUPLERS

Same quality we manufacture for one of largest dealers in the country. Small size makes them extremely efficient on amateur waves. Fine for radio telephone work. Will tune below 200 meters. Make your own regenerative set complete for less than $20. Why pay more? Order early for we anticipate a great demand at this special price.



Introductory Offer

K. C. Variometers $4.95
K. C. Variocoupler $5.95

Postage Prepaid

Western Radio Company

Fourth and Delaware KANSAS CITY, MISSOURI *Radio Station, 9XAB*

STOP! LOOK! and ACT!

We supply free of charge with each 50 watt U.V. 203 power tube, price $30.00, the standard General Electric V.T. socket, price $2.50; and with each 5 watt U.V. 202 power tube, price $8.00, your choice of 4 ampere C.E. rheostat, porcelain or Improved Murdock V.T. socket. Unsatisfactory Radiotron tubes will be replaced at once. No risk. Shipped postpaid and insured. Immediate delivery.

THE KEHLER RADIO LABORATORIES, Dept. R, ABILENE, KANSAS

(*Continued from page 418*)

and modulating their notes to make music—she must have had more receivers and more hands than I have. I cannot do it with two of each. But it was a good story and made people think about radio. No harm is done. Now someone ought to get the *Atlantic Monthly* to tell its dignified and considerable constituency that each and every one of them, with a dollar's worth of wire, galena and head phone, can gather in a few heavenly harmonies (not to mention QRN!) and a liberal amount of perfectly good jazz any evening at all, and that they can make sense as well as music out of the messages transmitted by Transatlantic stations, if they have receivers that will bring them in and a speaking acquaintance with the code.

In the same magazine is an ad. which every radio advertiser ought to study. It is a telephone ad. The story is told in a picture, with a few words used as amplifiers. It makes you forget all the wrong numbers and busy wires you ever got and concentrate on the fact that you can get help in a jiffy by using the telephone if the house is on fire. Again the occasional emergency cleverly capitalized, again the technical side kept out of sight.

Not being an advertising expert I do not presume to criticise the radio ads. in technical publications, but as an average man I do criticise the attitude on the part of the radio dealers, which kept me from getting a start in radio until I was driven into it by the war-time urge. I am not interested in securing advertising for magazines published for the average man. If the radio dealer is not in a position to pay for advertising space, let him write editorial copy and get the magazines to pay him, instead of his paying the magazines; but get the facts before the average man somehow.

Recently I saw a radio article in a magazine which had evidently been furnished free of charge on condition that the author be mentioned as Mr. Soandso of the Suchandsuch Company. The description and illustrations applied to that company's apparatus, of course. The biggest magazines will not enter into such an arrangement, but it is all right when it can be done.

The big idea is to get into the head of the average man that radio is a game for him. Show him pictures and diagrams illustrating how every farmer in a county can get the daily reports from the United States Bureau of Markets, if one amateur with a good receiver and a fair transmitter will pick them up and relay them by radiophone or by Morse, at slow speed. Convince the dancers that any one of their little social clubs could own and operate a set that would make radio dances possible.

Help the officers of big radio corporations to realize that the man who uses radio in his home is going to use commercial radio when he wants to send a message overseas. Is any man going to put a message on the cable, to be sent when and as the company pleases, when he can give it to the radio messenger and then listen in and check up the op. as he transmits it?

Show the politicians—if you cannot get it through any other way—that with a good radiophone transmitter at the State Capitol and a dollar's worth of receiver in every home, the Governor and all the lesser lights can talk directly to the voters and not have their rhetoric dimmed (until later!) by the comments of country editors. All of us who copy Government press know that they have a wonderful radio system working well in Washington! I haven't heard of such a thing as a democrat since March 4! Every State and county should have a radio system for direct contact between voters and their representatives.

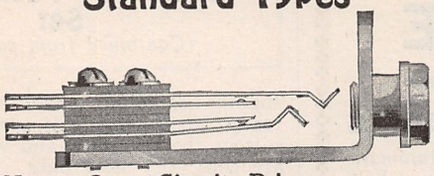
The telephone and code broadcasts already established present a strong enough argument for selling any average man a receiver which he could operate right from the start. Once started, a big majority would immediately become buyers of radio

AIDS TO BETTER RADIO WORK

PACENT RADIO JACKS

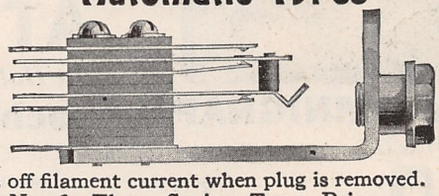
The New Pacent Radio Jacks are fit companions for the Pacent Universal Plug. Like the Plug they are not improvised telephone equipment, but have been designed especially for Radio. They are small, neat, and rugged. The most convincing proof that they are the best jacks for radio is the fact that Commercial Radio Companies are standardizing on them.

Standard Types



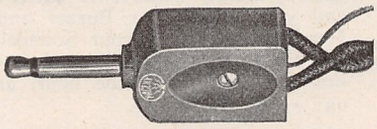
Cat. No. 61 Open Circuit, Price.....$ .70
Cat. No. 62 Closed Circuit, Price..... .85
Cat. No. 63 Two Circuit, Price..... 1.00

Automatic Types



Cuts off filament current when plug is removed.
Cat. No. 65 Three Spring Type, Price.....$1.20
Cat. No. 66 Five Spring Type, Price..... 1.50

The Pacent Universal Plug



Price $2.00

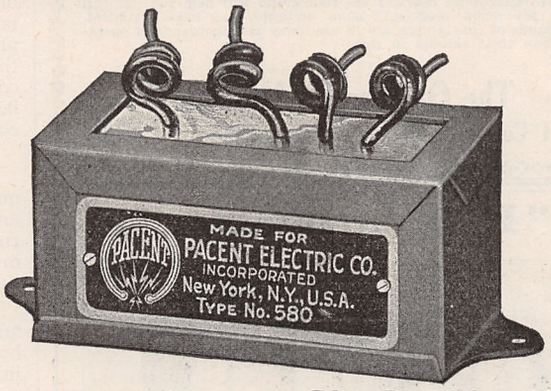
No connections to solder. Essential for modern radio, for transmission and reception. Approved by the Navy Department. Endorsed by foremost radio amateurs. We lead, others follow.

DUBILIER CW CONDENSER

For Antenna Series Use Type 580 For General C. W. Duty

MADE IN
Single Capacities
0.001 mfd.
0.002
0.005
0.01
0.02

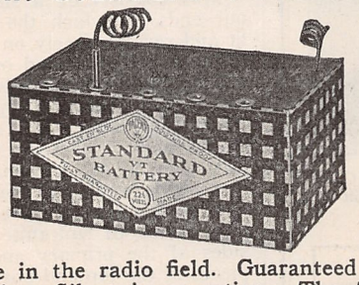
Price $4.00



CAT. No. 310
Triple Capacity
0.0003 mfd.
0.0004
0.0005
5,000 volts
4 amperes

Price $4.50

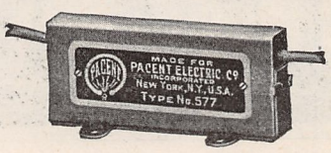
Pacent Standard VT Batteries



Supreme in the radio field. Guaranteed to give satisfaction. Silent in operation. The Standard "VT" Batteries are now supplied in the black and white boxes with diamond-shaped labels.

Prices range from $1.50 to $3.50 each

The Dubilier Universal Condenser



Type 577
Price $2.00

For transmission and reception. Supplied in most used capacities from 0.01 to 0.00025 mfd. Especially designed for C.W. Will carry 1 ampere at 1000 volts. Standard by many radio companies.

PACENT ELECTRIC COMPANY, Inc.

LOUIS GERARD PACENT, President

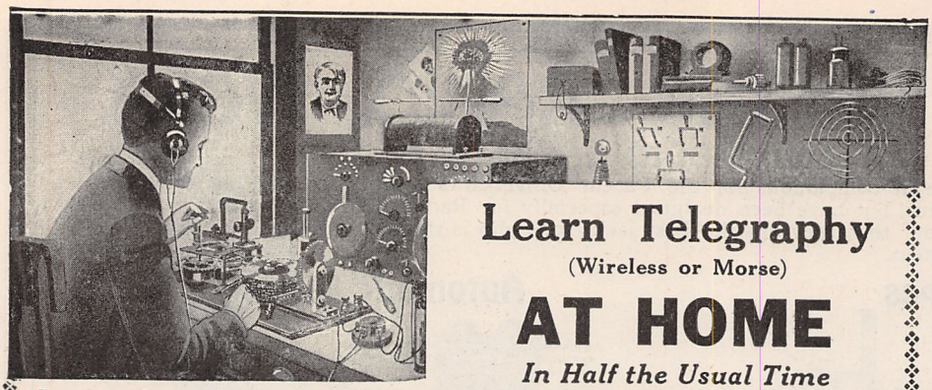
Sole Distributors for Wicony's Complete Line of "Eventual" Apparatus.

Duo-Lateral Coils
Standard VT Batteries
Pacent Plugs
Special Distributors for Brandes Phones

150 NASSAU STREET

Dubilier Condensers
Rawson Instruments
Seibt Instruments
Special Distributors of Westinghouse Equipment.

NEW YORK CITY



Learn Telegraphy

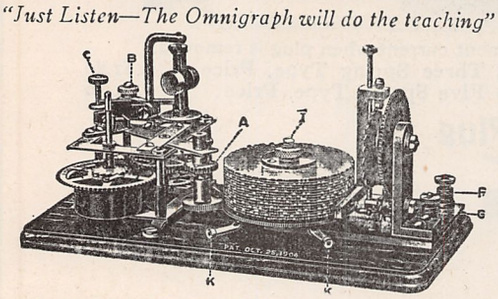
(Wireless or Morse)

AT HOME

In Half the Usual Time

Let the OMNIGRAPH Teach You Wireless

"Just Listen—The Omnigraph will do the teaching"



The Omnigraph is an *Automatic* Transmitter that teaches you both the Wireless and Morse Codes, at home, without any expense except the cost of the machine itself. Merely connect to battery and your Buzzer, or Buzzer and Head Phones, or to your Sounder and the Omnigraph will send unlimited messages by the hour, *at any speed* you desire.

USED BY THE U. S. GOVERNMENT

Write for Free Catalogue

The Omnigraph Mfg. Co.,26-H Cortlandt St.N.Y

Gentlemen:—

As per your ad in Radio News please mail me your free catalog of Omnigraphs.

Name.....

Address.....

City..... State.....

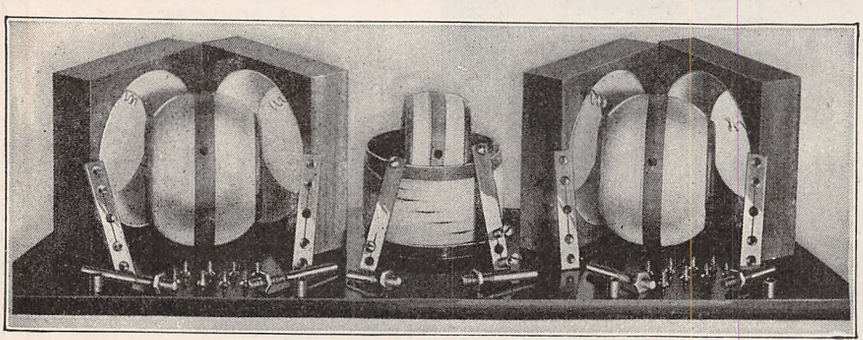
For a few dollars you can have a complete outfit that will make you an experienced operator in the shortest possible time. No hard, laborious work—just learn by listening. The omnigraph is adjustable so you can start receiving messages slowly, gradually increasing the speed as you become proficient.

You'll be surprised how quickly you will attain speed. Even if you are already an operator the Omnigraph will help you. It will make you more proficient, more accurate and more confident. Thousands of Omnigraphs are in use today and thousands of operators owe their success to them.

The Omnigraph Mfg. Co.

26-H Cortlandt St. New York City

Famous "Chi-Rad" K-D Variometer Set



All parts to build two variometers and one coupler. ALL WINDINGS IN PLACE—nothing to do but screw on bearings and connect up. Complete set can be assembled in 30 minutes. The biggest value on the market—order a set today. Immediate Delivery.

Price complete as shown $10.00 Add PP on 6 lbs.

Specifications

Variometer forms 4¾" Sq., 3" wide when assembled. Coupler primary Bakelite 3⅝" Diam., 3¾" high. All shafts ¼" diameter. 7 Primary Taps.

Range 150-475 meters. Special condenser to shunt secondary and increase range to 650 meters supplied for 35c extra.

Made specially for panel mounting—all screws covered by dials when assembled.

Immediate Delivery—Money Back Guarantee.

Chicago Amateurs—Come and inspect our stock—largest in the Middle West. Open all day Saturday.

Dealers—Write for attractive discounts on "Chi-Rad" K-D Variometers. Your customers want them!

CHICAGO RADIO APPARATUS CO., Inc.

508 South Dearborn Street (Second Floor) CHICAGO, ILL.

ANNOUNCEMENT

We wish to announce that the LIBERTY RADIO SUPPLY CO., located at 6808 Aberdeen St., Chicago, Ill., have reorganized and changed its name to the APEX RADIO SHOP and are located at 1105 W. 69th St., and are carrying a complete line of Standard Radio Apparatus and Supplies. Our MOTTO is SERVICE, PRICE and SATISFACTION. Local Amateurs invited to visit our new store. Open every afternoon and eve. from 4 to 10, APEX RADIO SHOP.

publications and bigger buyers of radio apparatus.

The money which the average man will spend this year for rubber balloons would buy him a radio receiver as good as the one with which I heard WJY broadcasting the Dempsey-Carpentier fight, and it would please all the family as much as the balloons do the kids.

Tell him so.

"Quadrant" Pocket Radio Set

(*Continued from page* 381)

slightly heated and forced into the holes already boxed in the quadrant. The heat softens the vulcanite, and when the nipples are cold, they hold tight. If there should be any looseness, a little shellac varnish applied will make them tight. The secondary is then wound with, say, 42 D.S.C. wire and the tappings taken off from points shown in sectional elevation of quadrant. The coil, when wound, can get a couple of thin coats of shellac varnish to bind the wires to the surface; this finishes the secondary. Fig. 2 shows the end view of the secondary, with the nipples acting as tappings for tuning.

VARIABLE CONDENSER

This is shown by the quadrant at the right-hand bottom corner of Fig. 1; on the semi-circular face of this quadrant is a metal face from which connection is taken to the nipple —. The corresponding semi-circular plate of condenser is fitted to a vulcanite block. On this metal face is a rubbing contact, or quadrant which is connected to nipple +. This spring must be insulated from the — face, as shown. The — face of the condenser can have a thin mica plate shellacked to it, in case of short circuit. This completes the variable condenser.

THE DETECTOR

This is shown on the top right-hand quadrant and is similar to the one designed and described by Mr. Robert Toran, in February RADIO NEWS. Other types of detectors can be used by the maker, as he prefers.

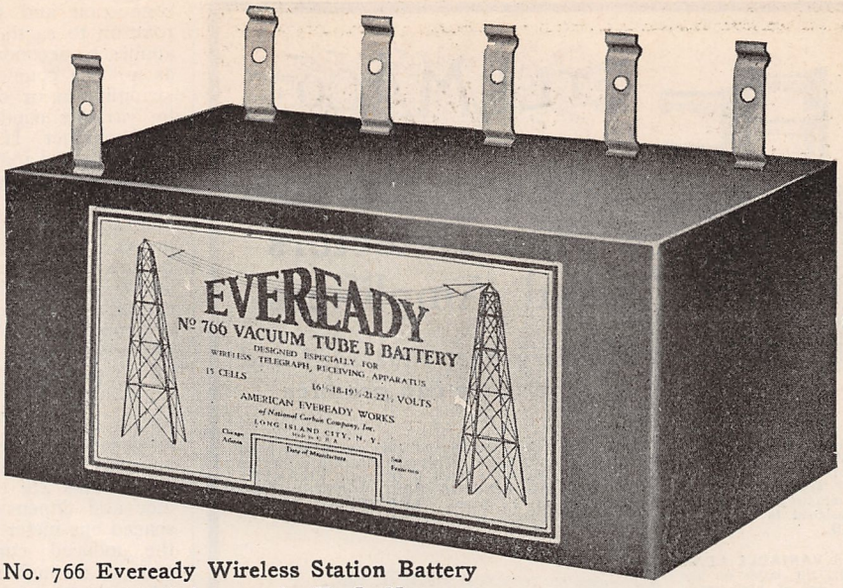
BLOCKING CONDENSER

This is shown as a small square in Fig. 1 and consists of tinfoil squares interleaved by waxed tissue, and should be shellacked in position before winding the primary coil.

PRIMARY COIL

This consists of a small, flat box without ends, in which the different quadrants fit and revolve freely on their centers. The primary coil is wound on this, beginning at the left-hand end, using, say, 36 D.S.C. wire, and tappings taken to top sockets, as shown. These are inserted in a supplementary piece of vulcanite. There is another supplementary piece at the bottom. These are placed in position when the primary coil is wound, and before outside sides are fitted. Two thin plates of vulcanite are placed to the sides of the primary and to supplementary pieces at the top and bottom; to these pieces it can be screwed, completing the coil. The bearings of quadrants are fitted inside these thin sheets, and flush with the surface of the primary. One plate is left off, the three quadrants are inserted in their proper positions, the bearings are inserted and the plate is screwed on. This prevents the bearings from coming loose and falling out. The plates also protect the surface of the primary coil and make a neat, finished job. Thumb-nail holes should be left to enable quadrants to be pushed out of coil similar to a penknife; these are shown in the accompanying drawings.

A coil of this type has all the connections outside, which is an advantage from an experimental point of view, as various connections can be tried, other instruments connected into various circuits and tuning can be done in different ways. For example, stud No. 6, primary could be used as aerial

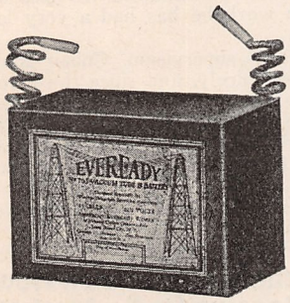


No. 766 Eveready Wireless Station Battery
Standardized for use in U. S. Navy

What makes the Eveready Wireless B Battery absolutely noiseless in operation?

Efficient depolarization; substantial connections; freedom from corrosive punctures and leaks. These are the features that give Eveready that absolute silence —that make Eveready the first choice for every receiving set.

Hitch an Eveready to your set—enjoy the marked increase in the effectivness of your equipment. Radio equipment dealers everywhere—or write us.



No. 763 Eveready Airplane Wireless Battery. Standardized for use in U. S. Signal Corps Aviation Section

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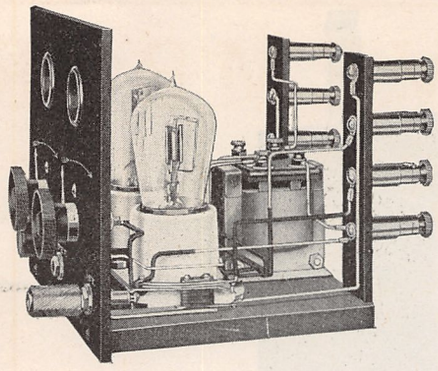
EVEREADY
FLASHLIGHTS AND BATTERIES

Every wireless operator has use for an Eveready Flashlight



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Telmaco Vacuum Tube Detectors and Amplifiers

The very best that skill and experience can produce

THE CABINETS are constructed of selected quarter sawed oak; stained inside and out; waxed and hand rubbed. **PANELS** are of grade M 3/16 in. Formica, 6⅛ in. high; grained finish. They are attached to drawer shelf, permitting complete assembly to be instantly removed and used without cabinet if desired. **FILAMENT CONTROL RHEOSTATS** are of approved type. **TELMACO SPECIAL BINDING POST CONSTRUCTION** is used throughout, entirely eliminating all wiring from the front of the panel. **AMPLIFYING TRANSFORMERS** are of new type, designed to operate with maximum efficiency with the new type tubes. We furnish them **FULLY MOUNTED.**

The **GRID CONDENSER** and **VARIABLE LEAK** are wired in the detector circuit, the latter on the front of the panel. **SOCKETS** are of high grade construction to fit tubes having standard four prong bases. **LETTERING** on panel is pantograph machine engraved and filled with best grade of white enamel.

FULL AUTOMATIC CONTROL JACKS are wired into these amplifiers. **RADIO PLUG** is furnished with the above.

Order Direct From This Ad

Satisfaction guaranteed always or money refunded. Send for our complete, new catalogue "N." You'll find it interesting; it describes everything in Radio

Your panels engraved with our **GORTON ENGRAVER. Price 5 cents per letter. Minimum charge $2.00.**

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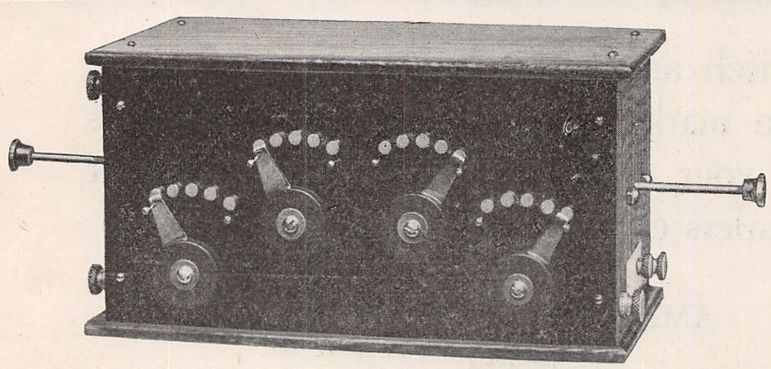
TYPE TD-1 TELMACO VACUUM TUBE DETECTOR UNIT $15.00
TYPE TDA-1 TELMACO DETECTOR AND SINGLE STAGE AMPLIFIER UNIT.....$35.00
TYPE TA-2 TELMACO TWO-STAGE AMPLIFIER $40.00
TYPE TDA-2 TELMACO DETECTOR AND TWO-STAGE AMPLIFIER $45.00

RADIO DIVISION

TELEPHONE MAINTENANCE CO.

17 N. LaSalle Street
CHICAGO, ILL.



GET THE PHONE CONCERTS LOUD AND CLEAR

This 200-600 Regenerative Tuner brings in the radio phone concerts great. It will give you a greater range—louder signals—more joy and pleasure. It has a real quartered oak cabinet with hard rubber panel. Price only $20.00. Order now and save money.

Mr. Charles A. Christopher, 524 Cross St., Rochester, Penna., says: "Have written to several of the users of Colby tuners and they all praise your tuners highly. In fact several of them have put aside their large regenerative sets and are using yours on account of the ease in getting the stations and music."

Send a 2-cent stamp for bulletins.

Colby's Telegraph School Auburn, N. Y.

Insure your copy reaching you each month. Subscribe to *Radio News*—$2.00 a year. Experimenter Pub. Co., 236-A Fulton St., N.Y.

connection and the others plugged in on rotation to earth, or vice versa. This also applies to secondary. The coil can be used as a loose coupler and the tuning done by swinging in or out secondary quadrant, or by variable condenser, or the two can be used together. If the primary and secondary are connected together, we get a variometer action, in fact the number of combinations and circuits that can be used is unlimited. The size of the coil will depend upon the maker's taste, but it could be made extremely small and compact. The use of cycle spoke nipples adds to its neatness, and these can be procured cheaply at any bicycle shop or store.

Cuban Radio Station

(*Continued from page 379*)

and closely coupled one with the other. The secondaries are two coils, similar in diameter and dimensions to the primaries, and spaced one meter apart. Copper ribbon leads the induced current to the aerial and ground, through special electrode insulators. The antenna lead in insulator is a huge corrugated rod, 6″ in diameter in the center and 2′ high. The ground outside of the insulator is of similar dimensions, and leads the conductor to a counterpoise system of grounding. As the land near and surrounding the building is very dry and rocky, the Government designer, Mr. M. O. Mallo, thought it better to erect a counterpoise, and 76 wires are run radially from the station house, and are distributed all over the camp. Some of them run to the roof insulators of the edifice, as can be seen in the photograph.

This station is magnetically controlled from Havana's receiving station by means of a 100-ohm, Bunnell relay, and a small Western Union sending key. The permanent wave-length of the equipment is 2,150 meters, and this special wave is not changed at any time. The station works every day at 12 m., 12:30 p. m. and 1 a. m., giving long distance service to ships on the Atlantic. Latest reports show that this station has been heard 25 miles eastward, on the Bermudas, and down to English Guiana.

The towers supporting the antenna are important; they are 200 meters high, and are spaced 400 meters apart; having 10 wires, this antenna is easily visible from any part of the city.

The station was erected in 1918 by the Chief of the Radio Department of the Cuban Mail Service, Mr. M. O. Mallo, who is one of the wisest men of the country in Radio telegraphic and electrical matters, and is claimed to be the best designer of high power Transatlantic wireless stations, in which work he has had a very long experience.

Under his supervision, Cuban Radio stations work nicely, and since the erection of the stations, no changes of interest had to be made at any of them. Slight changes for improving the service, and special work for the better development of better transmission and reception, were and are still being made on behalf of the people using the service.

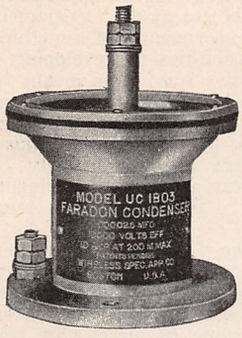
Farmers Are Shown How to Receive Radio Market Reports

(*Continued from page 379*)

as to show the different markets and commodities covered. On this board was also posted a special report on the Buffalo market sent from the Buffalo office of the Department of Farms and Markets by telephone.

When market reports were not being received, the apparatus at the exhibit was adjusted to pick up whatever long-wave sending happened to be in the air at the

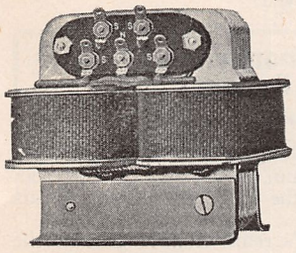
CONTINENTAL SERVICE COVERS THE WORLD. EXTRAORDINARY SERVICE AT ORDINARY PRICES



R.C.A. CONDENSERS FOR C.W. TRANSMISSION

Faradon type condensers, specially designed for Radiotron transmission. Highly efficient, and priced extremely low in proportion to quality. Four types in stock.

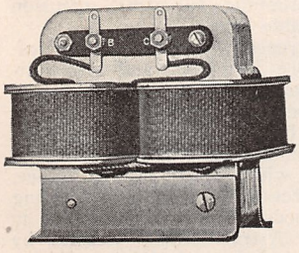
	Price
Model UC-1014, capacity .002 mfd., voltage, 3,000 V.	$2.00
Model UC-1015, capacity .0003, .0004 and .0005 mfd., voltage 7,500 V.	5.40
Model UC-1803, capacity .000025 mfd., voltage 10,000 V.	5.00
Model UC-1806, capacity .002 mfd., voltage 6,000 V.	7.00



FEDERAL 150-WATT FILAMENT LIGHTING TRANSFORMER.

A highly satisfactory, and the long run, the most economical method of lighting the filaments of your VTs. Connects directly to any 110 volt, 60 cycle source of supply.

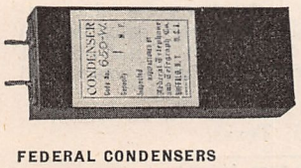
$15.00 Each.



FEDERAL 2-5 HENRY FILTER COIL

is of high impedance value for A.C. and a negligible resistance to D.C. It is highly recommended for use with both transformer and generator plate voltage supply.

$7.50 each.



FEDERAL CONDENSERS

Designed for use in connection with the Filter Coil above. Two sizes:

650 volts, 1 mfd.	$1.65
1000 volts, 1 mfd.	2.00

(Discount on quantity)

All the way from Honolulu

they send to Continental for radio supplies. Read this letter, recently received: "Today I am sending you a radio again for some wireless supplies. You are getting me delivery in fifteen days from the day I cable you, which is some service to the center of the Pacific."

(Signed)

CYRIL O. SMITH.

Permanent address:
The Royal School,
Honolulu.

From Honolulu to New York, and back, in fifteen days. That means we shipped the order the day we got it. It means we had the goods right on hand, ready to be shipped at once. And we must have shipped it well, or Mr. Smith wouldn't keep on sending to us for all his radio supplies.

Are you getting that kind of attention to your mail orders? Try Continental the next time you need radio supplies. Our service covers the world. No matter where you live, you can count on the same courtesy by mail, that you would receive in the store itself. No excuses, we make good!

There are still a few copies left of the Creco 112-page catalogue. Send a quarter for your copy, which will be credited to your first $5.00 order. In the meantime, look over this list of specials, and order direct from the ad. Please help us to avoid any delay whatever, by making remittance by P.O. Money Order or bank draft.

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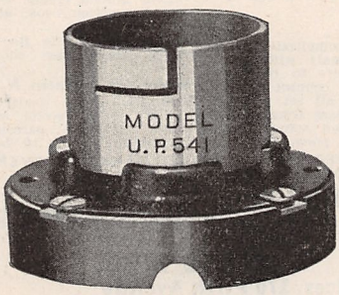
Every instrument on this page, and countless more, are liberally stocked at the Continental store, ready for immediate shipment. Order now,—your apparatus will be shipped the day we receive your order, and will be sent as carefully as we can possibly pack it, to arrive in perfect condition.



R. C. A. Porcelain VT Sockets

Specially designed for use with Radiotrons and Kenotrons. Splendid value.

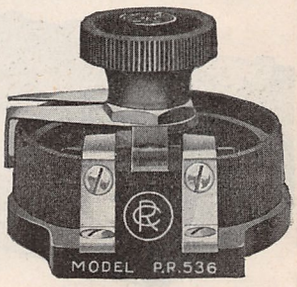
Model UR-542 ..... $1.00
(For Radiotrons UV-200, 201, and 202; Kenotrons UV-216.)

Model UR-5.1 ..... $2.50
(For Radiotron UV-203, and Kenotron UV-217.)

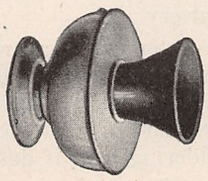
R.C.A. "A" Battery Potentiometer

It is impossible to overestimate the desirability of using a potentiometer in connection with the gas-content detector, Radiotron UV-200. This is the only way proper detector action and resulting increase of signal audibility can be obtained.

PRICE $20.00

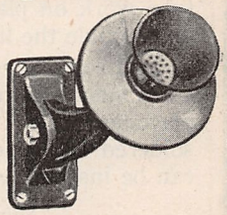


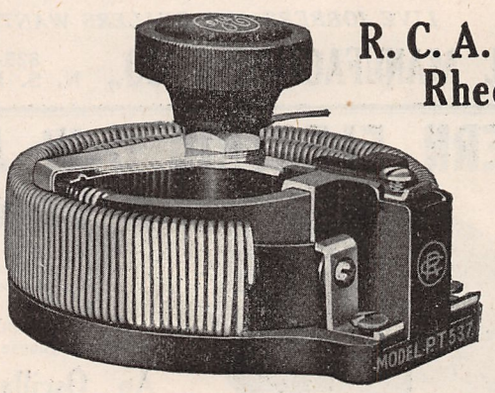
Federal Radio Microphones



Designed for panel mounting. Represent years of extended research to produce highly efficient microphones at reasonable prices. Right—Black pony arm. Nickel polished microphone. Left—Full nickel polish.

Price of either type: $5.25





R. C. A. Filament Rheostats

Specially designed to get best results out of Radiotrons. Body is composed of an asbestos-content, fire-proof insulating material.

Model PR-535 is for use with Radiotrons UV-200, 201, 202 and Kenotron UV-216. Price $3.

Model PT-537 is for use with Radiotrons UV-203, 204 and Kenotron UV-217. Price $10.

METERS (Weston Model 301)

Model 301 O-3 amperes flush	$8.50
Model 301 0-15 amperes flush	8.50
Model 301 O-50 volts flush	8.50
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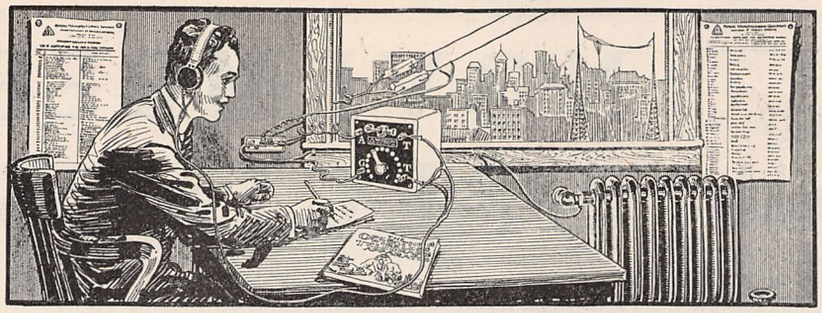
C. W. INDUCTANCES

No. 181 Tuska C.W. Inductance	$7.50
No. 181 Tuska C.W. Inductance unassembled	5.00
No. 182 Tuska C.W. Inductance	10.00
No. 182 Tuska C.W. Inductance unassembled	7.50
No. 183 Tuska C.W. Inductance	12.50
No. 183 Tuska C.W. Inductance unassembled	10.00



COMPLETE RADIO RECEIVING OUTFIT

No additional parts required; complete in every detail. No batteries or other expensive renewal parts needed.

No license, or special knowledge necessary for operation; radio receiving outfit can be quickly set up for use.

Wave length range 180 to 2,500 meters.

It is not necessary to have a high, complicated antenna structure to receive radio signals with this set. Just connect a single aerial wire to the receiving set, ground one terminal, and connect phone to the other terminals and you are all set to receive all kinds of radio signals: messages from amateur stations, ships, wireless telephone speech and music, time signals, weather reports, press, etc.

COMPLETE "MARVEL" RADIO RECEIVING OUTFIT, Model 105 (as illustrated), consisting of a Model 101 "MARVEL" Radio Receiver, 150 ft: antenna wire, telephone with leather covered headband and telephone cord, 5 porcelain insulators, ground switch, ground clamp, code chart, abbreviation chart and instruction book, all put up in attractive box **$15.00**

"MARVEL" Radio Receiver, model 101, with code chart, abbreviation chart and instructions **$8.00**

Write for bulletin N-101.

Buy from your dealer; or sets will be shipped C.O.D. or on receipt of Postal or Express Money Order. Include parcels post charges. Shipping Weight Model 105, 10 lbs.; weight Model 101, 4 lbs.

LOOK FOR THE REGISTERED TRADE MARK ON EVERY GENUINE "MARVEL" RADIO RECEIVER; OTHERS ARE IMITATIONS.

RADIO MFG. CO. TRADE MARK REG.

DEALERS: We are looking for several well established dealers to sell these sets in the various sections of the country. "MARVEL" Radio Sets are now widely advertised, and should prove to be a "best seller" in the fall and around the Holidays. Write for proposition.

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Executive Offices, 170 Fifth Avenue New York, N Y.

Pat. apd. for

No. 100—22½ Volts
Size 7 x 4¼ x 2⅝

HIPCO

Wireless B Battery
Refillable Variable

PRICE $3.00

Refillable and variable B Battery especially designed for Vacuum tube work on plate circuits is guaranteed to be perfectly noiseless, it will give double the life of the ordinary battery.

The above cut shows part of the cover cut away which illustrates the convenience in inserting a new cell should one prove defective. These replacements are furnished complete with a positive and negative terminal soldered fast, and will be sent to any address upon receipt of 25c. They can be inserted without the use of soldering iron if desired.

Sample mailed to any address upon receipt of $3.00.

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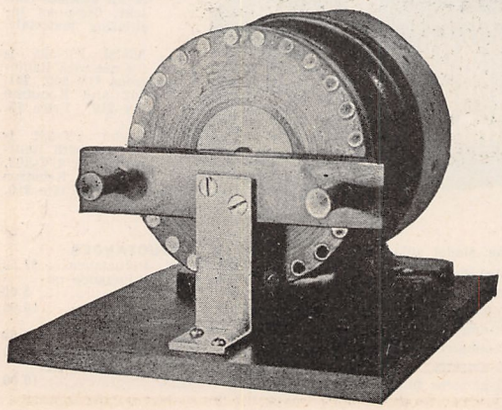
NORTHERN ELECTRIC C-W APPARATUS



A TONE WHEEL

in that C-W set of yours will make your station cut thru Q.R.M. Motor driven, therefore a constant note. Order your's today.

Price without motor $10.00
Westinghouse motor $21.00

An Oscillaiton Transformer

designed solely for Radiotron power tubes should be in your station. Made with copper strip and genuine hard rubber insulation. Tunes to 350 meters and gives maximum radiation.

Price $8.00

A postal brings our catalogue.

NORTHERN ELECTRIC COMPANY
P. O. Box 371 SCHENECTADY, N. Y.

time. The sound of this sending being amplified by the Magnavox resulted in arresting the crowds passing the exhibit at all times of the day, thus giving an opportunity for explaining the object of the Department in conducting the experiment and something concerning the possibilities in developing a complete market news service by means of reports sent by radio. About every hour during the day the receiving apparatus was tuned so as to pick up phonographic music being sent out from the nearby City of Syracuse by wireless phone, arrangements having been made to this end with a local sending station.

On the whole, we feel that the demonstration was well worth while. We ourselves learned much concerning the practical possibilities in sending our market news reports by radio, while as an exhibit feature the demonstration proved especially interesting to the State fair crowds. It seems clear that the radio means of transmission for market news reports has a great future if receiving equipment can only be installed at enough shipping points to make the sending worth while. Especially does it seem worth while to consider the possibilities of the wireless phone in relaying such reports sent to various central distributing points in code. The Department of Farms and Markets intends to experiment further along this line with the possibility of ultimately developing a complete State-wide service by radio when funds are available, and provided that the problem of receiving the reports can be solved.

Correspondence From Readers

(*Continued from page* 404)

not agree with him, he get off our American ships and join the merchant marine of his liking.

Mr. Reberger's remarks have touched the officers of the Department of Commerce, the Radio Inspector, the American operator and about everyone else but himself.

Please have Mr. Reberger answer my questions and ease my mind.

JAMES E. SELLAN.

Tampa, Fla.

Editor RADIO NEWS:

Your editorial, "New Uses for Radio," in the September issue of RADIO NEWS, has supplied the stimulus for this intrusion upon your valuable time.

Therein reference was made to Prof. Fessenden's "Ore Detector" and also intimation of the *possibility* of R-A-D-I-O being used for locating oil.

Locating oil by wireless is now a demonstrated fact in Texas, also in Venezuela, by the British, while flying through space.

There are three distinct ways of locating organic substances: First, as described in my book, "The Astral Child." Second, by wireleess through Etherical Waves (Hertzian Waves), the most practicable and scientifically reliable method. Third, by wireless in connection with the earth's electrical currents.

If your Electrical Engineers fail to grasp and construct a "wireless" that will not only locate oil, but all organic substances, register Grade, Quality, Quantity and Value of substance located, send for me and I'll instruct them as to "How To Do It." Or, I will forward instructions for the construction of a wireless-locater, provided you will condescend to send me, if not the first one, then the second one that is constructed by you.

A. H. MENLY.

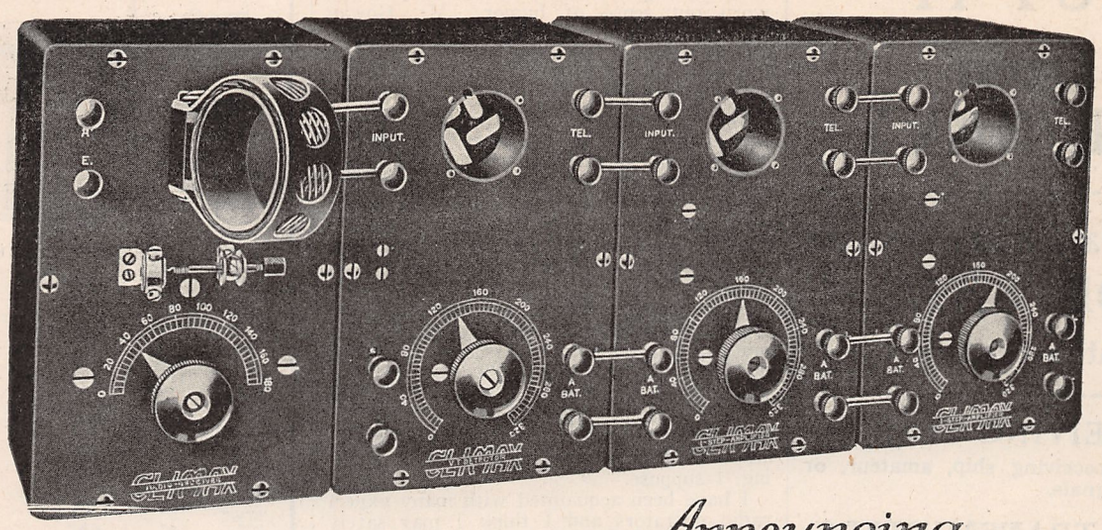
Corpus Christi, Texas.

THE NAVY HITS BACK

Editor RADIO NEWS:

It surely must have taken a great deal of Mr. Gowan's time and energy to write the "book" which appears in RADIO NEWS

EVERY COMBINATION OF CLIMAX UNITS RECEIVES ALL CLASSES OF SIGNALS, WIRELESS TELEPHONE AND TELEGRAPH



Announcing

CLIMAX UNITS

at rock-bottom 1922 prices

YOU CAN NOW get all the splendid performance of *ABC UNITS* at un-heard-of low prices.

For CLIMAX UNITS, tho' costing less, bring you every necessary feature for a commercial-grade receiving station. The illustration shows the CLIMAX receiver, VT detector, and two one-step amplifiers, hooked together to form one compact, result-getting set. This entire outfit sells for only $54.25 (less tubes and batteries.) You can buy one Unit at a time, and yet get remarkable results from each succeeding combination as you go along.

In quality, CLIMAX UNITS equal any sets on the market. Genuine Condensite insulation is used for the condenser heads. The receiver comes to you equipped with the No. 25 *ABC* Coil (range 150 to 300 meters). Larger coils may be instantly snapped into the mounting, giving you unlimited wave-length range. *ABC* Saco-Clad transformers used in the amplifier Units, make six steps entirely practical without howling or squealing. Remember, these Units are completely enclosed cabinets, with a handsome Kodak-finish that you will be proud to show to your friends.

Quantity production of three simplified models, based on 1922 prices for raw materials, saves you 50% or more of what such instruments would otherwise cost. Here's your opportunity to build up your set and save money. Order one or more Units direct from this ad. Immediate delivery. Prices include postage to any part of the U. S.

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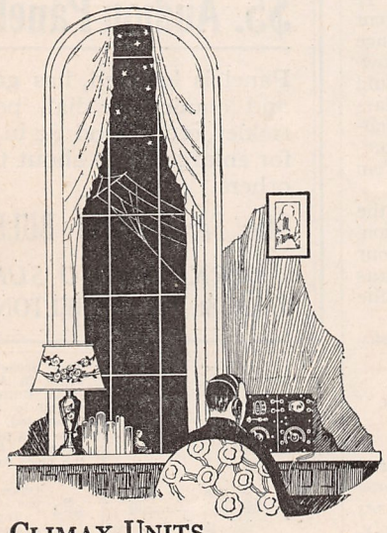

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Navy Dept. Washington, D. C.

for September. I am wondering if he hasn't something better to do than to start a "heluva" argument through the columns of a publication. Birds like that with long, drawn-out epistles certainly ruffle my rather worn out sense of humor. Mr. Gowan would make a good marathon runner with all his wind. How does it happen that he has just read RADIO NEWS for May? He's very much behind the times.

Here's an answer for your "Kick" No. 1, Mr. Gowan: In the first place, linotype operators for a publication such as this do not make such glaring mistakes as you may think. The word "full" could hardly be mistaken for "low" by one who wishes to hold his position and reputation, especially in this country; I don't know how it is in yours.

The sentence relative to "sharp tune and high decrement" was evidently an error on my part. I don't know, because I haven't my May copy of RADIO NEWS at hand, but what I can't understand is why Mr. Gowan is calling attention to a mistake which appeared in the May issue, in SEPTEMBER; another "Rip Van Winkle" just awakening, I suppose.

I have been acquainted with many expert radio operators and I think I may safely say that probably about one in every ten knows the first thing about compass work, and that one operator, unless he has had some experience, could not take a bearing which would be accurate or even fairly so. I have a sneaking suspicion that the Honorable Mr. Gowan is one of these latter. Probably he uses a silver antenna and rubber insulation with his ten-kilowatt gap for his short-wave work.

Does Mr. Gowan mean to imply that a radio operator of the American Navy knows nothing about the apparatus he uses? If so, let him show that man to me. That is not the way our Navy is run, nosiree.

PAUL MANSFIELD.

DAD WAS PLEASED.

Editor RADIO NEWS:

In your summary in connection with your Radio Accessory Prize Contest, in the September issue of your admirable magazine, you state that "there really was not a single idea that could be termed startling or brilliant."

May I be permitted to suggest that possibly the rewards offered were not large enough to attract this class of ideas? If a man has something worth getting a patent on, he would scarcely submit it for a chance of a fifty dollar prize, would he? Now if some patron of the radio game would hang up a prize of, say, a five-year scholarship in the Massachusetts Institute of Technology, with expenses paid, perhaps something would be evolved that would make 'em sit up and take notice.

Possibly you may be able to detect the "nigger in the wood-pile" in this suggestion. The winner of the second prize, in your present contest, is a junior in the Kansas High School, and a five year's course in the place referred to would suit him fine!

Is he tickled over his prize? I'll say he is!

The writer is his dad.

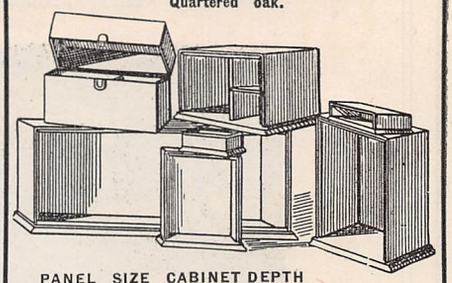
WM. B. LABAR.
3207 East 27th St., Kansas City, Mo.

(Unfortunately, this publication is not a philanthropic institution. We would love nothing better than to give monthly prizes of from $1,000 upwards. Unfortunately, however, this publication, along with many other unfortunate ones, just manages to pay its monthly bills. For that reason we feel that the small prizes we offer from time to time are about as far as we can go, and there is no other publication in the field that does even half as well, as far as prizes are concerned.

Neither can we quite agree with Mr. LaBar as to the amount of the prize money, for many ideas are simply ideas as such and cannot be patented. On the other hand

De Forest Cabinets

Hand rubbed, waxed early English finish. Quartered oak.



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11½"	11½"	6⅜"		4.25
11½"	14"	6½"		5.25
8¾"	1¾"	4"		1.50
13½"	7"	10"		5.00
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8"	9"	6⅞"		5.25
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15"	9"	6⅞"		5.75
14"	9"	6⅞"		4.00
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25"	9"	6⅞"		7.50
27½"	9"	6⅞"		9.00
32"	9"	6⅞"		10.00
8½"	17½"	18¼"		7.00
9½"	7"	4¼"	with hinged cover	3.50
11⅞"	8"	4¼"	with hinged cover	2.00
4½"	4½"	1⅜"		.90

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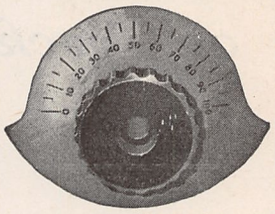

Lacquered brass, 2½" in diameter, genuine bakelite knob 1¼" in diameter. Offset shoulders act as stops. Same dial used by U. S. Signal Corps. Your money refunded if not satisfied. Price, three for one dollar, postpaid.

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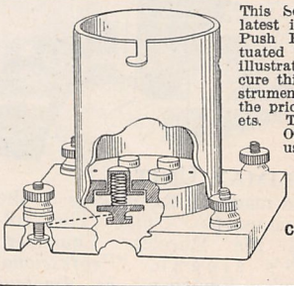

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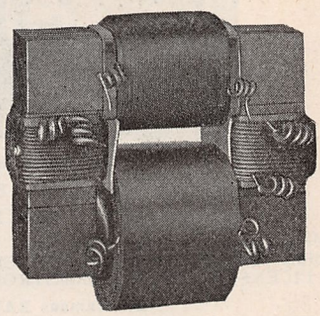
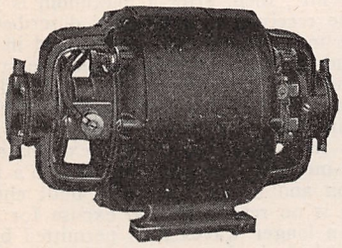
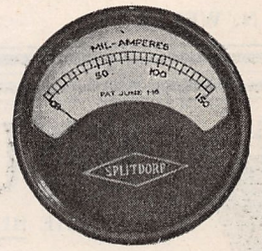


Acme C.W. power transformers. Unmounted. For 60 cycle, 110 volt supply. 3 secondary windings. 6, 12, and 1000 volts, with center tap on high voltage. Designed to furnish 500 volt D. C. when using standard rectifier tubes. Works efficiently with all makes of tubes. $12.50

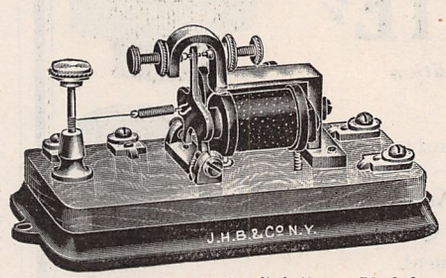


Guaranteed ESCO dynamotors 110 volts D. C. to 500 volts D. C. 100 watts. Ball bearing type; one unit. This is the best possible outfit for C.W. plate supply. Smooth running. Noiseless in operation. Large overload factor of safety. Reduced to $65.00.



Guaranteed standard indicating instruments at manufacturer's cost.

Hot wire ammeters, General Radio, scale		0-7	$7.00
" " " " "	"	0-2	7.00
High Frequency ammeters, Roller Smith	"	0-5	22.50
Filament ammeters " "	"	1.5, 0, 1.5	8.00
" " Weston	"	6.0-0-1.5	9.00
D. C. Ammeters, Splitdorf.....	"	0-2	5.75
" " " "	"	0-3	5.75
" " " "	"	0-5	5.75
Hot wire Ammeters, General Radio	"	0-10	7.00
D. C. Milliammeters, Splitdorf....	"	0-150	5.75
" " " General Radio	"	0-250	7.00
Filament ammeters, Amer. Everready	"	1.5-0-1.5	3.80



Bunnell relay operating on 6 volt battery. Ideal for electro-magnetic transfer switch. $3.98

Ward Leonard vitrohm resistance units for filament current adjustment and other uses. The best obtainable. Absolutely constant resistances.

5 ohms with ferrules, 7¾" x ⅝"	$.90
60 ohms no ferrules, 2" x ⅝"	.65
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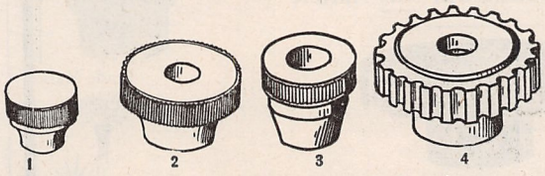
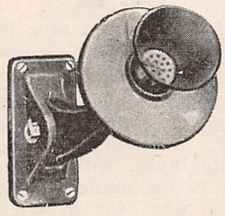
5000 ohms graphite sectors, 2½" x ⅜" x ¼" for adjustable grid leak resistance	.55

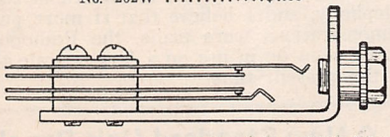


Knobs for switches, rheostats, variometers or condensers.

No. 1 ¾" top diameter	$.06	No. 3 15/16" top diameter	$.10
No. 2 1¼" top diameter	.08	No. 4 1½" top diameter	.15



Panel type microphone on japanned arm ready for mounting. Low resistance No. 262W $4.00



Federal telephone jacks with polished nickle plates No. 1423W ... .$.90

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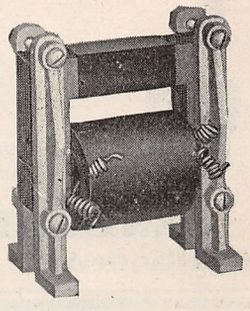
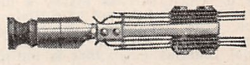
The mounting bands have been perfected so they are absolutely impervious to moisture; lower distributed capacity, lower high frequency resistance, and better made in all respects than any other coils of this type now on the market.

DL-25	$1.40	DL-300	$1.75
DL-35	1.40	DL-400	1.80
DL-50	1.50	DL-500	2.00
DL-75	1.50	DL-600	2.15
DL-100	1.55	DL-750	2.35
DL-150	1.60	DL-1000	2.60
DL-200	1.65	DL-1250	3.00
DL-250	1.70	DL-1500	3.50



Acme A3 modulation transformers on mounting brackets. Exceptionally efficient input transformer for Radio telephone work.....$5.00



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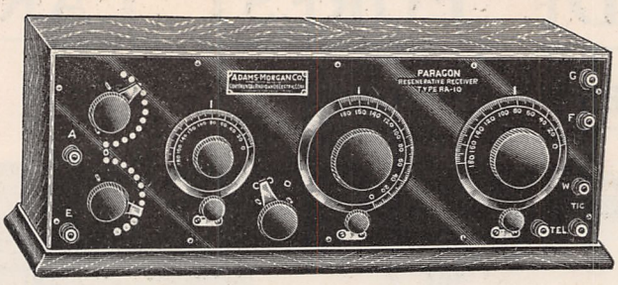

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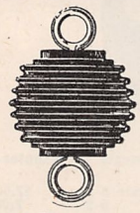

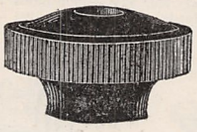

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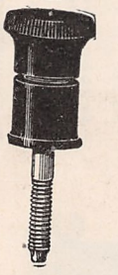

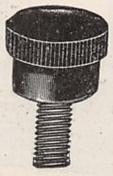

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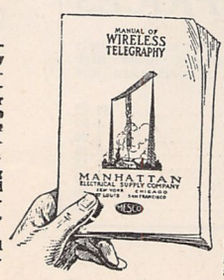
WIRELESS MANUAL M12

You should have it even if only superficially interested. Around about you every day you read of some marvelous occurrence in which wireless played a distinguished part. It may not be entirely clear to you. The Manual will explain it. To the student of Wireless Telegraphy, the Manual contains much that is indispensable to a proper understanding of the art.

It contains 200 pages, fully illustrating and describing the many instruments used in Radio. 45 pages cover general instructions, diagrams, station calls, tables, codes and other information.

The book is printed on highly finished paper with a two-color cover and measures 9 x 5¾ inches.



Containing as it does a fund of valuable information not generally contained in a catalogue, it approaches nearer a text book in the fascinating field of wireless telegraphy. No expense has been spared to make it accurate and reliable.

No Wireless Experimenter Should be Without the Mesco Wireless Manual. We ask 25 cents (25c) for it—give you a coupon receipt which can be applied on any future order.

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we have demonstrated that there is no better protection for an idea than having it printed in a national publication.

If, within a year's time, the idea proves to be a success, the original inventor can always have the idea patented without any trouble, and the very fact that the idea was published, gives him the most valuable document he could wish for. In other words, he gets a priceless priority over others who come later.—Editor.)

How to Make and Use a Wave Meter for Short Wave Lengths

(*Continued from page* 385)

the condenser, look horizontally on the left at the crossing of the vertical line with the curve. The horizontal line leads to the scale on the left, which reads in microfarads the capacity of the unknown condenser.

If it is desired to make a condenser having a greater value than the capacity of the wave-meter, another condenser of known capacity should be connected in parallel with the variable one, and the measurement effected as before. If, for instance, you wish to make a .0018 mf. condenser, first connect an .001 fixed condenser in parallel with the variable, which should be set at 147° for .0008 mf.; then, after a maximum is found in the receiver, as previously described, the home made condenser is connected in place of the calibrated capacities and the surface of the armatures increased or reduced until the maximum is heard again, without changing the tuning of the receiver.

As may be seen by this explanation, a wave-meter is a very useful thing in a Radio station and since it may be built cheaply, there is no reason and no excuse for sending on longer waves than permitted by the law, which is for us very liberal in comparison with the restrictions of the other countries on experimental Radio. If you are not rich enough to build a wave-meter, your club can easily make one by collecting only a few cents from each member and allowing them to take the wave-meter home for personal experiments when needed by them.

Regarding the construction of this instrument, the writer will be glad to answer any additional queries that may be sent him, provided a stamp is enclosed for the reply.

Radiophone in Costa Rica, C. A.

(*Continued from page* 383)

miles away, a short aerial and a portable receiving set with which we could hear the music being transmitted, very clearly and quite loudly. This set may be seen in one of the photographs, with a few amateurs listening in to the music and the voice of their friend, who was in charge of the sending set.

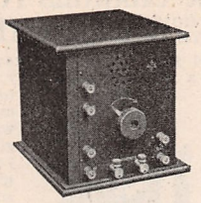
It is surprising to see how easily amateurs and others become interested in Radio telephony, and I believe that if more public demonstrations were made, the Radiophone would soon be in use on a larger scale than at the present time.

A New Standard Unit Panel System

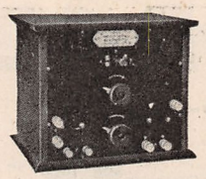
(*Continued from page* 383)

the circuit in the form of brass connectors, thus eliminating all loose wiring besides having other advantages which make for efficiency. A panel may be taken out and another substituted in much less time than is ordinarily required. Of course the system as described may be modified in several

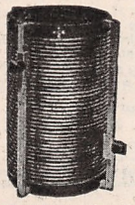
ACE



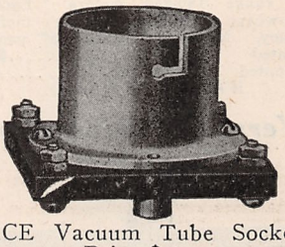
Type ATC Detector Cabinet.
Price $12.00



Type A-2 Two-Stage Amplifier
Price $40.00



ACE C.W. Inductance
Price $6.50



ACE Vacuum Tube Socket
Price $1.50

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The word "ACE" engraved on Radio Equipment is your bona fide guarantee that the apparatus bearing this trade-mark is unsurpassed as to quality, workmanship and efficiency.

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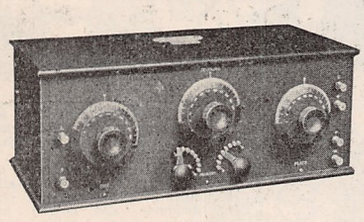
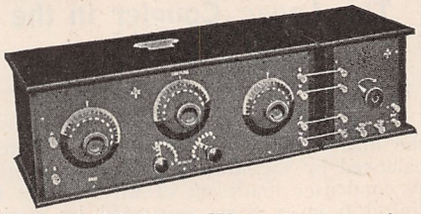
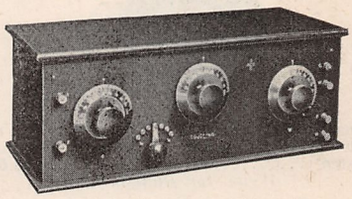


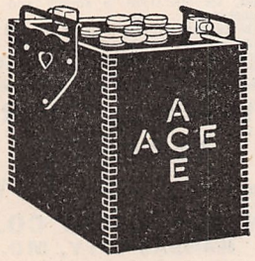
Type AVA Regenerative Tuner
175-475 Meters. Price $45.00



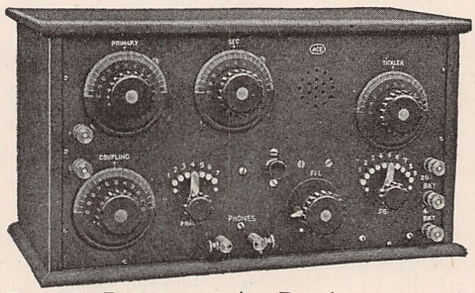
Type AVC Short Wave Regenerative receiver, 175-475 Meters, Price, $56.00



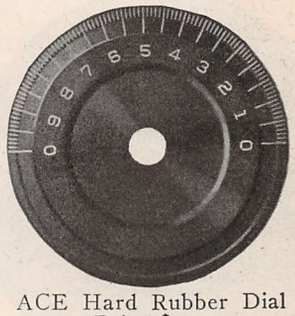
Type AVB Regenerative Tuner
150-475 Meters. Price $32.00



ACE 6-Volt, 80 Amp. Hr. Storage Battery. Price $18.00



Type TTR Regenerative Receiver—150-3000 Meters. Price $75.00



ACE Hard Rubber Dial
Price $1.50

We carry in stock at all times a complete line of reliable Radio Supplies for the Amateur and Experimenter.

SEND 5c IN STAMPS FOR CATALOG

AMATEURS!
If your dealer cannot supply you write us direct
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CABLE ADDRESS,
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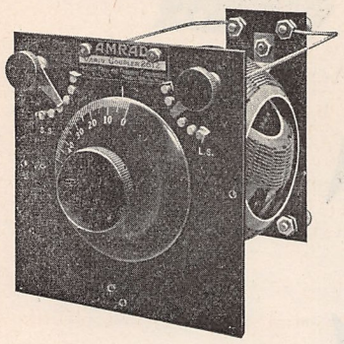
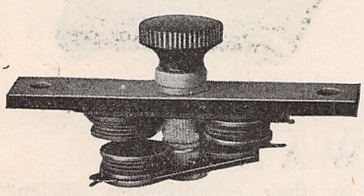
AMRAD

Vario-Coupler



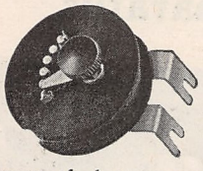
Designed to work with two Amrad Variometers to form Regenerative Tuner with wave range 180-350 meters. Exclusive basket-weave windings giving increased efficiency. Mounted on 5" x 5" panel as illustrated $13.00
Unmounted $6.90
Write for Bulletin O.

Vernier Variometer



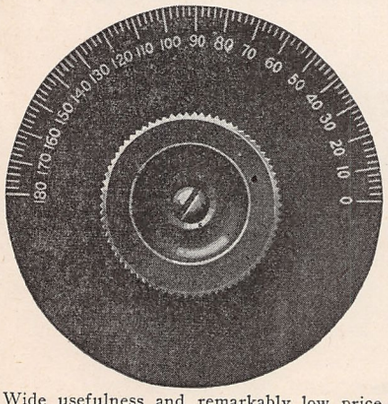
Latest device for C.W. work. A miniature variometer for use in regenerative sets of maximum efficiency. As illustrated...$1.50
Write for Bulletin N

Adjustable Load Coil



Increases range of short wave set up to 3000 meters. A real necessity. As illustrated $3.50
Write for Bulletin L

Knob and Dial



Wide usefulness and remarkably low price make this 3" Dial, either 90° and 180°, the best buy of the season. Reduced price .....$.50
Write for Bulletin R

AMERICAN RADIO AND RESEARCH CORPORATION
203 COLLEGE AVE.
MEDFORD HILLSIDE 57, MASS.
NEW YORK 15 PARK ROW
CHICAGO 600 SO. DEARBORN ST.

respects. For instance short pieces of wire may be used instead of rigid connectors.

Also, as an elaboration, instead of using round-head screws for the binding posts, a threaded brass rod ¾" long may be used, in which case a hexagon and battery nut is placed on both sides of the panel. This will allow the making of external connec- to any of the instruments.

Junior Constructor

(*Continued from page* 403)

The base or mount was made of wood cut down to a semi-circle, and black shellacked. It works fine; try it, fellow "hams."

Contributed by KOPPLER LOOSE.

BEATS THE HONEYCOMBS

For short wave-lengths, you will find the following coils most efficient, and very easily and cheaply constructed.

Cut off three 1" lengths of cardboard tubing 3½" or 4" in diameter, and shellac inside and out. Now bank-wind a double layer of 25 turns of No. 24 S.C.C. wire on two of the forms, and 35 turns on the third, fastening the winding with shellac, or preferably with a bit of sealing wax. These may now be mounted on the Corwin plugs, so you can use them in your honeycomb coil mounting.

Care must be taken that the coils are poled the same; this may be checked by placing a compass in the center and exciting the coil by a small battery. The deflection must be the same for each coil with the same battery connections.

Using the small coils for primary and tickler, the large one for secondary, I hear plenty of amateurs and radiophones up here, while with the regular honeycombs, I have little success with one bulb.

Contributed by FORREST DREW.

The Loose Coupler in the V. T. Set

(*Continued from page* 388)

There was, of course, some noise from the line, but this was more than counterbalanced by the increased signal strength. A condenser made up of three sheets of tinfoil 6 in. x 8 in. separated by waxed paper was inserted between the inductance and the line to prevent grounding the line.

Practically all the high-power, undamped Atlantic coast stations and BZR have been heard. NAA (undamped) is audible 25 ft. from the phones, and NDD, 15 ft. Time has been received frequently from NBA at 1 P.M. (Eastern time). Earlier in the season XDA could be heard loud enough to be easily copied between 8 and 9 P.M., but is seldom heard distinctly now.

The greatest disadvantage of this set is the fact that the connections must be changed greatly for each hook-up, because of the wide differences between them. A jack and plug system or some similar arrangement might be employed to advantage.

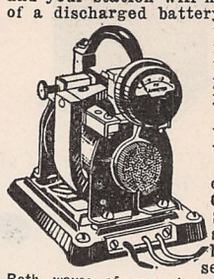
Amateur Reception on Honeycomb Coils

(*Continued from page* 388)

etc. My aerial is large and I need an L25 as primary with a 43-plate condenser set at 180°. Sometimes the bulb oscillates best with a series condenser and sometimes with none at all. At any rate, once it is set, leave it in one place and do your tuning on the secondary condenser.

10c CHARGES YOUR BATTERY AT HOME WITH AN F-F BATTERY BOOSTER

and your station will never be closed because of a discharged battery. Is it not gratifying to feel that your filament battery will always be ready when you want it and that you will never have to give up in disgust when working a distant station?



F-F Battery Boosters charge Automatically, Operating Unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up. Both waves of current are rectified thru adjustable and easily renewable carbon electrodes, which maintain a constant efficiency and last for thousands of hours. Also charges batteries right in Autos. No skill required. AMMETER shows you the amount of current flowing. EVERYTHING COMPLETE IN ONE COMPACT, SELF-CONTAINED, PORTABLE CHARGING UNIT. F-F Battery Boosters are Magnetic Rectifiers for 105-125 Volt, 60 Cycle, Alternating Current. PRE-WAR PRICES Bantam Type 6 Charges 6 Volt Battery at 6 Amperes $15 Type 166 Charges 6 Volt Battery at 12 Amperes.. $24 Type 1626 Charges Both 6 and 12 Volt Batteries.. $36 Also BOOSTERS for 12 Volt Batteries at same prices. The Larger Types are for heavy batteries, or where time is limited. Shipping Weights 12 to 15 Pounds. Order from your Dealer or Send Check for Prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters Charge batteries from Farm Lighting Plants & D.C. Circuits.

For GROUP CHARGING use the Full Wave. Automatic F-F ROTARY RECTIFIER of 100 Volt, 36 cell capacity.

Order Now or Write for Free BOOSTER Bulletin No. 32 or ROTARY Bulletin No. 32A

THE FRANCE MFG. CO. Offices & Works: Cleveland, Ohio, U.S.A.
Canadian Rep: Battery Service & Sales Co., Hamilton, Ontario

NEW MOTORS FOR ALL PURPOSES STANDARD MANUFACTURERS PROMPT DELIVERY
ALL SIZES UP TO 5 H.P.
We Specialize In Small Motors & Generators
ALL PHASES AND FREQUENCIES IN STOCK AT ALL TIMES
Largest exclusive Mail Order Small Motor dealers in the world.
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500 VOLT - 100 WATT - 3400 R.P.M.
FOR MOUNTING MOTOR GENERATOR SETS.
$28.50 EACH
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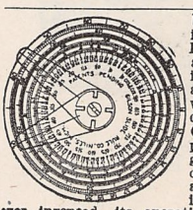

The Midget "FIVE-IN-ONE" Slide Rul is a combination Mannheim, Log-Log, Add and Subtract, Polyphase and Binary Slide Rule. It will instantly add, subtract, multiply and divide any combination involving whole numbers, fractions, decimals and mixed numbers. Gives every possible root and power of every quantity. The graduations are printed on metal coated with white celluloid and are grease and waterproof. While it is the most versatile calculator ever invented, its operation is simple and easily understood. Diameter 4".

Price with 16-page Instruction Book, $1.50. Leatherette carrying case 50c extra. Catalog free.
Your money back if you are not satisfied
Gilson Slide Rule Co., Niles, Mich

WIRELESS EXPERT WANTED
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CENTRAL RADIO CO. Inc.
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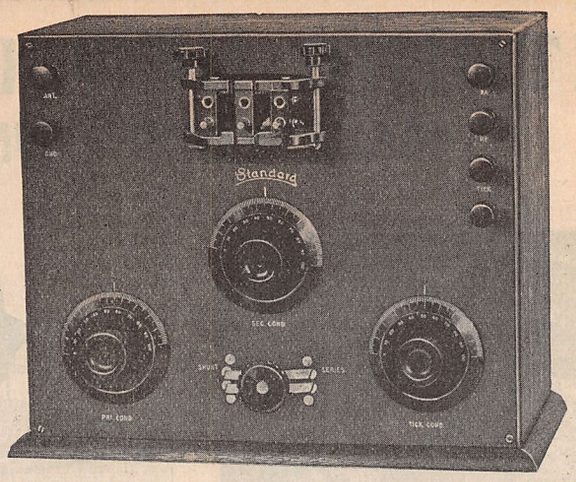
WIRELESS TELEGRAPHY
Make your own "Wireless," also Dynamos, Batteries, Motors, Telegraph, Telephone, Lights, Bells, Alarms, Coils, Current Reverser, Electric Engines, etc. Book with 75 Illustrations; by experts so anyone can understand it. With Catalog. All 10c, 3 for 25c p.p
J. C. DORN
705 So. Dearborn St., Dept. 21, Chicago, Ill.

Now, as to C.W. (amateur) reception. Both your tickler and tickler coils will require closer coupling with the secondary. The tickler needs to vary from directly against the secondary to ¼ in. away. The primary needs about 1 in. separation from secondary and generally can stay in one place. For example, say the bulb oscillates at 40° and you have been getting spark stations from 30° to 40°, and you wish to tune in C.W.: Set the primary at about 1 in. from the secondary, the tickler about ¼ in. out, and tune from 40° to 90° for C.W. Ordinary C.W. stations with 200-meter licenses will be found up as high as 280 meters. You can leave the tickler stationary and just tune on the secondary condenser if you wish. However, a slight variation of tickler, after the C.W. has been tuned, will usually increase the strength. For phone stations the tickler will have to be pulled away from the secondary until the bulb almost stops oscillating and close coupling of the primary and secondary is necessary.



Multiple Wave Tuner

WITH this instrument you can receive spark, arc or CW., both telephone and telegraph on any wavelength between 150 and 20,000 meters.

It is guaranteed satisfactory or money refunded after inspection. Sent anywhere in the U. S. on receipt of ⅓ the list price. If satisfactory remit the balance, if not, return the instrument.

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WIRED $50.00
UNWIRED ... $45.00

Send stamp for details.

Standard Assembling Co.
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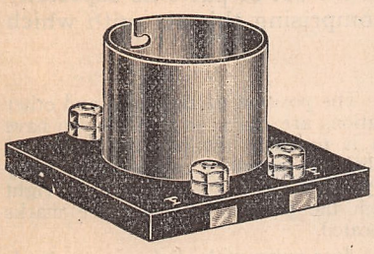

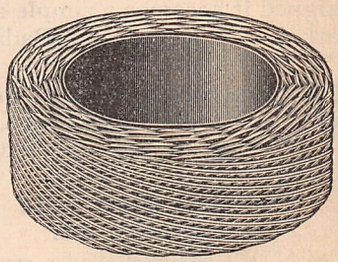

FREE

Your choice of either a V. T. Socket or a Duo-Lateral Coil Absolutely FREE *with* Every $10.00 Purchase or BOTH FREE With Every $20.00 Purchase

We are overstocked with radio goods of every kind. No matter what you need, we have it in tremendous quantities. In order to convert this stock into cash, we are not only offering big price reductions on a great part of our standard supplies and apparatus but in addition, we will, for 60 days only, give absolutely free on every $10 sale, your choice of either this well-known V. T. Socket (Regular Price, $1.25), or this D. L. Coil (also regularly sold for $1.25). Or you can have both free with any purchase of $20 or over.

This offer applies to any goods in our stock. A complete stock of all leading standard wireless equipment always on hand ready for immediate shipment.

SAVE MONEY BESIDES

Read these Specials at tempting price reductions

Western Elec. Phones; were. 15.00
Special at 11.00
Lightning Switches, 100 amp., 600 volts; reg. $4.50
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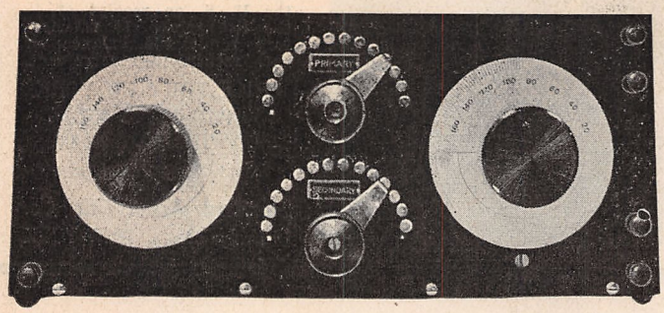

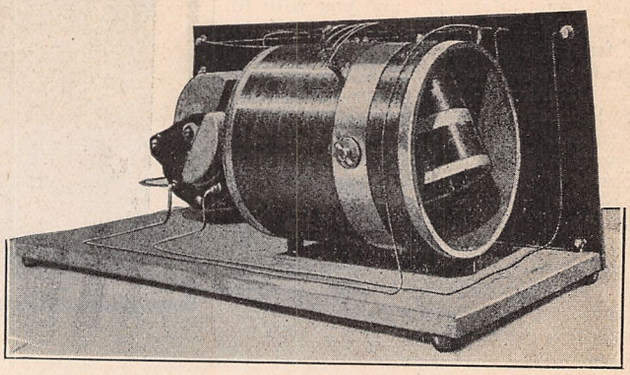

You can build this regenerative receiver easily without a machine shop. With the set of patterns especially designed it becomes a simple and easy work to make and assemble the parts comprising this set with which spark, C. W. signals and Radiotelephony may be received.

WE hereby offer the first of our series of "Make Your Own" apparatus set, the first one being a

Complete short wave regenerative set.

One of the foremost Radio engineers has constructed this set for us, specially for the amateur, and by our modern, novel methods of construction, anyone is able to make an efficient apparatus for the reception of wave-lengths up to 800 meters.

The circuit used is of the single inductance type and is the same as that used in new and well-known expensive sets recently placed on the market. With this circuit, a good selectivity is obtained, owing to the fact that the resistance of the winding in this set is rather low and so does not practically affect the resistance of the aerial, which consequently operates as a wave collector with maximum efficiency.

Another benefit resulting from the use of this circuit is the simplicity in tuning, a factor not to be neglected by the amateur not having had a long experience with regenerative circuits, in the reception of damped, undamped and radio telephone signals.

In building a Radio apparatus the lack of mechanical knowledge often handicaps the amateur in such a way that the instrument he builds has not the standard made appearance which is desirable in any Radio apparatus. In order to remedy this, and give the amateur a chance to turn out an efficient and handsome looking instrument, we have designed a special set of patterns enabling anyone to make a standard receiver with all the improvements that can be found in expensive ready-made apparatus.

With this set of patterns and by following the instructions given it is very easy with the use of only a few tools to turn out the short wave regenerative receiver shown in our two photographs.

The novel departure in this set of patterns is that we do not merely give you pictures of how the apparatus looks, and mere diagrams—BUT EACH AND EVERY PATTERN SUPPLIED IS FULL SIZE.

Take for instance the pattern for the panel. It is printed on heavy blue-print paper exactly the size of the panel to be used. The position of the holes and other markations are exact, so that all you have to do is to paste the pattern on top of your bakelite panel by means of ordinary library paste, and when dry drill right through the pattern wherever the marks are located.

This does away with all fussing and calculating as we have done all the laying out in our own shop, and you need not worry that the final instrument does not come out right.

Similar methods are used for winding the tubes, where a complete pattern is furnished so you cannot go wrong. For instance, the pattern is wound upon the tube; then you can wind the wire right on top of this, if you wish. *We have done the thinking for you.*

BEFORE SELLING YOU THIS PATTERN WE HAVE GONE TO THE TROUBLE OF ACTUALLY BUILDING THE OUTFIT AND WE KNOW THAT IT IS ABSOLUTELY RIGHT IN ALL PARTICULARS.

The original may be inspected at any time. Only standard parts are used in making the outfit. It is possible to build the entire set as illustrated for about $12 to $15.

Complete and very explicit directions go with the pattern which is furnished in a heavy envelope 9 x 12".

Complete pattern for short wave regenerative set each prepaid

50c.

Either Direct from us or for sale by the following responsible Dealers:

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Alamo Sales Corp., Indianapolis, Ind.
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Brode Electric Co., Los Angeles, Cal.
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California Elec. Co., San Francisco, Cal.
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Central Radio Co., Independence, Mo.
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Chase, Geo. H., Newport, R. I.
Chicago Radio Ap. Co., Chicago, Ill.
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Delancey-Felch & Co., Pawtucket, R. I.
Detroit Electric Co., Detroit, Mich.
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Findley Electric Co. Minneapolis, Minn.
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Mohawk Elecl. Sup. Co., Syracuse, N. Y.
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Newman-Stern Co., Cleveland, O.
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Monographic Charts for the Calculation of Capacity Inductance and Wave Length

(*Continued from page 391*)

centimeters, we connect the capacity of .0005 mf., the circuit will have a wave-length of about 152 meters, as shown by the white line drawn on the chart, as an example. If, to an inductance of 32,000 centimeters, we connect a capacity of .0002 mf., we find that the wave-length is the same, for by joining 32,000 on the right scale, to .0002 on the left one, the joining line crosses the wave-length scale at the same point.

Some value of inductance larger than those shown in the scale may be used; the value of capacity being .0005, and inductance 1,300,000, it is found that the combination would respond to a wave-length of approximately 1,520 meters. To find this, connect .0005 mf. on the left with 13,000 on the right and read 152 on the center scale. Since the square root of the number by which 13,000 must be multiplied in order to get 1,300,000 is 10, multiply 152 by 10 and get 1,520 meters, the correct wave-length to which the circuit will respond.

All these charts are accurate enough for practical measurements that the amateur wishes to make when building apparatus, or to determine the characteristics of the instruments he possesses.

STATEMENT.

Of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912, of RADIO NEWS, published monthly at New York, N. Y., for October 1, 1921.

State of New York }
County of New York } ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the RADIO NEWS, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Experimenter Publishing Co., 233 Fulton St., New York City, N. Y.; Editor, Hugo Gernsback, 233 Fulton St., New York City, N. Y.; Managing Editor, Robert E. Lacault, 233 Fulton St., New York City, N. Business Manager, R. W. DeMott, 233 Fulton St., New York City, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) Experimenter Pub. Co., 233 Fulton St., New York City, N. Y.; Hugo Gernsback, 233 Fulton St., New York City, N. Y.; Sidney Gernsback 233 Fulton St., New York City, N. Y.; R. W. DeMott, 233 Fulton St., New York City, N. Y.; H. W. Secor, 233 Fulton St., New York City, N. Y.; Dr. T. O'Conor Sloane, 233 Fulton St., New York City, N. Y.; Mrs. Catherine Major, 233 Fulton St., New York City, N. Y.; M. M. Finucan, Hartford Bldg., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers

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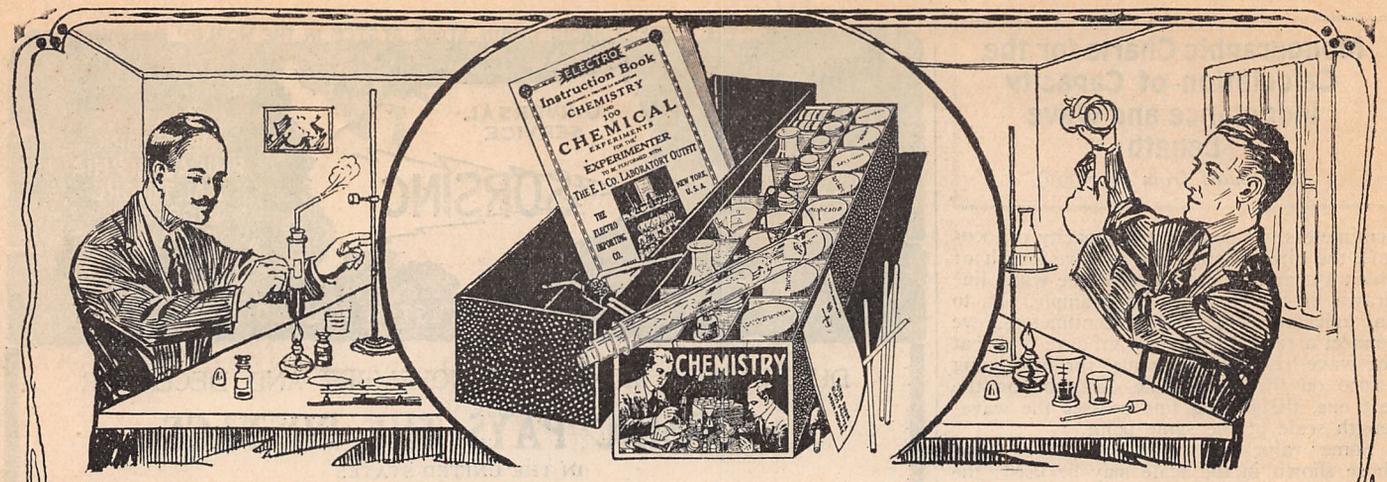

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Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_4 2H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5\ (OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
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Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
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Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
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Sodium Sulphite (Na_2SO_3)
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Sworn to and subscribed before me this 14th day of October, 1921.

[SEAL] JOSEPH H. KRAUSS,

Notary public of Queens and authorized to act in New York.

(My commission expires March 30, 1923.)

RECTIFICATION.

In the October issue of RADIO NEWS, the Advertising Department made a mistake in the ad. of the American Radiogram Company appearing on page 366, quoting "Relay Radiograms" at 30c. per pad, whereas the copy should have read 35c. per pad.

Groundless Wireless

(*Continued from page 389*)

the short-wave type, the author receives regularly from a station in Florida, amateurs in every district except the sixth. Using the receiver of the long-wave type, foreign stations are copied in the daylight hours. These results are obtained with the hook-up here shown, no steps of audio frequency amplification being used. A ground can be inserted in the position indicated by the dotted lines in the diagram. The experimenter will find that the only effect of adding the ground will be to alter the wave-length of the circuit slightly.

Working the short-wave groundless receiver, in comparison with the regular market type variometer receiver, will show that the regenerative variometer set has nothing on the groundless for bringing in the signals.

A Short-Wave Receiver

(*Continued from page 390*)

right of the front view, and the gears can be seen at the bottom left of the rear view. The secondary condenser is made up of the same plates as the primary condenser, but has a capacity of about 0.0033 microfarads. A similar counterbalancing weight is employed here as in the primary condenser.

The secondary coupling coil is the rotating coil in the coupler, and swings inside the primary coupling coil from —30 to 120 degrees. Maximum coupling is obtained at 120 on the scale, seen in the front view, minimum coupling at zero on the scale. The object of the reverse coupling from 0 to —30 is to neutralize any capacity coupling which may exist due to the proximity of connecting wires and different units of the different circuits.

Unlike receivers designed heretofore, this receiver separates the coupling function from the loading. The coupler is a distinct unit apart from the loading coils, and the design has been such as to distribute the inductances in the loading and coupling coils so that maximum efficiency in reception is obtained. To assist this, it will be observed from the rear view that the primary and secondary loading coils are placed at right angles so that no inductive coupling exists between them.

The tickler inductance is mounted inside the secondary loading coil, the rotating shaft and spring being visible on the outside of the loading coil in the rear view. The tickler rotates through an arc of 90 degrees, from 0 to 10 on the tickler coupling scale in the front view. At 0 the plane of the tickler is at right angles to the plane of the secondary loading coil winding, and at 90 it is parallel with the secondary plane. The tickler has been so designed in value of inductance and position in the circuit.

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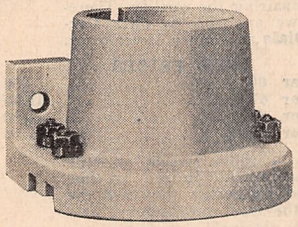
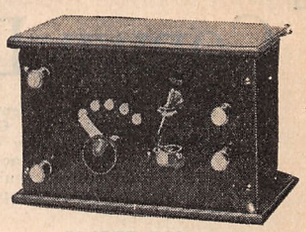


Here are the reasons why this socket won instant popularity—why it was the hit of the Chicago Radio Show—why today it is the biggest seller. It's the only socket made for both base and panel mounting. It's made in one piece, entirely of porcelain—there is no metal shell—hence no "ground hum." Its design eliminates possibility of short circuiting filament across high voltage "B" Battery. It is better—and costs only 60 cents.

Be sure to use CROSLEY SOCKETS in the radio set you are building. Every live dealer handles them—if yours doesn't send us his name and order direct—we will ship prepaid.

HARKO RADIO RECEIVER

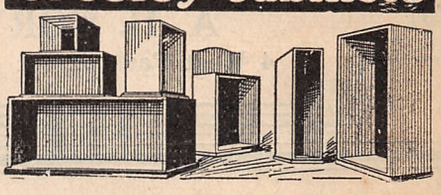


No batteries, tubes, etc., required. Hook it to your aerial and phones. It will tune from two hundred to six hundred meters, bringing in spark, voice and music, with an average amateur aerial.

Complete with battery and interrupter for crystal testing, crystal, etc. Price $9.00. Phones extra.

DEALERS: This will help you get 'em started.

Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions, etc. Realizing the demand for attractive stock cabinets of various sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbated in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

All cabinets are waxed antique mahogany finish. Wood used is either gum, genuine solid mahogany or quartered oak. Lids or tops are hinged. Sizes and prices are shown below:

CABINETS

For Panel Size	Inside Dimensions High	Wide	Deep	Mahogany or Quartered Gum	Oak
6x 7	5½"	6½"	7"	$2.50	$3.85
6x10½	5½"	10"	7"	2.75	4.40
6x14	5½"	13½"	7"	3.30	5.55
6x21	5½"	20½"	7"	3.90	7.30
9x14	8½"	13½"	10"	3.70	6.80
12x14	11½"	13½"	10"	4.40	6.80
12x21	11½"	20½"	10"	5.25	10.60

Ca[illegible]t accompany order. No C.O.D's. We pay [illegible]tation charges.

[illegible]nish genuine formica panels 3/16" thic[illegible] the following dimensions: 6x7; 6x10[illegible] 6x14; 7x12; 6x21; 7x18; 9x14; 12x1[illegible]; 18x21. Price of panels—3½c. per squa[illegible] For odd sizes order the next largest siz[illegible]ll trim. We pay postage.

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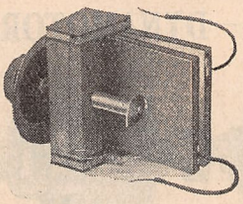
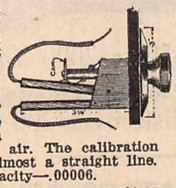
The Crosley Variable Condenser
(*Pat. Pend.*)

"BETTER—COSTS LESS"



This Condenser works on an entirely new principle. The two plates are hinged and are opened and closed like a book by means of a specially designed cam. The plates are surfaced with copper. One copper sheet is covered with mica so that when the two plates are clamped tightly together the maximum capacity is obtained. The maximum capacity of this Condenser will average about .0008. We rate it conservatively, however, at .0005.



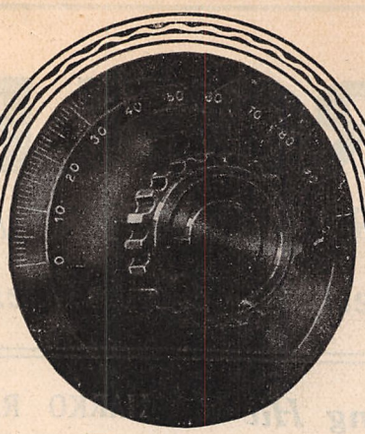
This Condenser has several advantages over the ordinary type of air condenser. Will stand 1000 volts without breaking down. It can therefore be used for C.W. work. Has no body or hand capacity effect. Has much greater signal strength due to the fact that mica is a much more efficient dielectric than air. The calibration curve of this Condenser is almost a straight line. Has unusually low zero capacity—.00006.

Price without knob and dial.....$1.25
With knob and dial..... 1.75
Mounted in cabinet with knob and dial..... 2.50

Sold on a GUARANTEE of absolute satisfaction or money refunded.

DEALERS: **It will pay you to handle our line. Write for particulars**

CROSLEY MANUFACTURING CO.
Radio Dept. R-5 **CINCINNATI, O.**



CORWIN DIALS~*reduced*

No falling off in sales demanded the price reduction of **Corwin Dials**. The high quality of the finished dial, plus their accuracy and ease of operation, would justify the upholding of the present cost.

On the contrary, the increased demand by amateurs who know, plus efficient marketing, has lowered the cost of production, without impairing the quality. Therefore, we are able to offer **Corwin Dials** at a much lower price.

OLD PRICES		NEW PRICES	
Number 66	75c	Number 66	60c
Number 67	$1.30	Number 67	$1.00
Number 68	1.00	Number 68	.80
Number 69	1.70	Number 69	1.20

The distinction **Corwin Dials** impart to a radio station is only exceeded by their accuracy and ease of operation. Judged by time they are the oldest on the market, judged by design they are the newest, judged by performance they are the most satisfactory; and judged by price, they are the best value obtainable.

At all Radisco agencies and other reliable Dealers or sent postpaid anywhere.

A. H. CORWIN & CO.

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TRADE **ESCO** MARK

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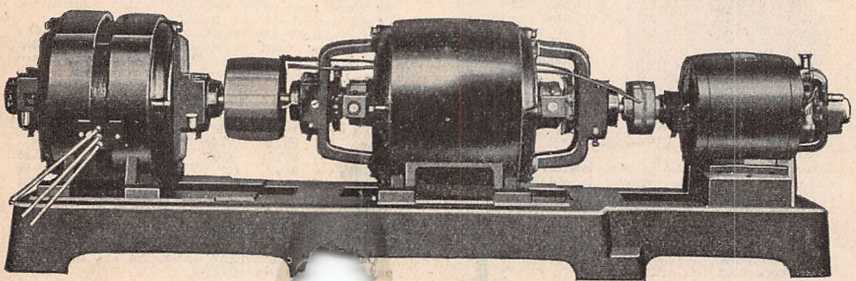

4 to 32 Volts for [illegible]at—350 to 2000 Volts for Plate.
Capacity 20 to 200[illegible]atts—Liberal Ratings.
Write for Bulletin 2[illegible]hich lists over 200 Combinations.

MOTORS AN[illegible]RATORS DEVELOPED FOR [illegible]L PURPOSES

PIONE[illegible]MANUFACTURING

High Voltage Direct Current Radio Generators

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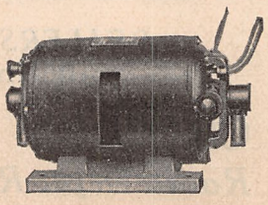


that when properly connected to the plate circuit of the valve through the Audion Control Box, oscillations of the receiver are obtained over the entire range of the receiver.

All of the inductance coils used are designed so that their natural wave-lengths are below the range of the receiver for reasons given above. They are all put through an impregnating and baking process which drives all moisture from the coil and which renders it moisture-proof. It will be observed that the wiring has been so arranged that there are no groups or bundles of wires running parallel to one another, as is so frequently found in fine looking sets, for the reason that groups of parallel wires result in high capacity coupling. All wires are encased in black empire tubing.

It will be of interest to note here the details of the windings of the various coils.

PRIMARY LOADING COIL

The primary loading coil is wound on a natural dilecto form 4" in diameter by 7¼" long. The winding starts 1⅛" from the end and is wound as follows: Two layers, bank wound, 18 turns per layer, are wound along a length of 1", then one layer of 62 turns along a length of 3", then two layers, bank wound, 18 turns per layer again along 1", thus ending the winding 1⅛" from the right hand end. This makes a total of 134 turns in the primary loading coil.

SECONDARY LOADING COIL

This is wound on a form 4" in diameter and 6½" long. As stated above, this loading coil is wound in four sections as follows: Winding starts about ¾" from left hand end. The first section is wound along a length of ⅝" and is wound in two layers of 10 turns per layer. The second section is separated about ⅝" from the first and is wound in one layer of 12 turns. The third section is wound in two layers of 20 turns per layer along a length of 1⅜", and the last section is wound in three layers of 26 turns per layer. The total number of turns in this loading coil is thus 150 turns.

SECONDARY COUPLING COIL

This is wound on a form 4¼" in diameter, ⅞" wide, and has three layers, bank wound, of 15 turns per layer, making a total of 45 turns.

PRIMARY COUPLING COIL

This is wound on a form 5½" in diameter and 1½" wide, and has four layers of 24 turns per layer, making a total of 96 turns.

All coils are wound with No. 3 x 16 x 38 Litzendraht.

Looking at the front view again, the other details not described as yet are as follows: Next to the primary inductance switch is a metal case encasing a standard entury buzzer used for test purposes. This is operated by a dry battery connected to its appropriate binding posts on the right side of the receiver, and the switch operating it is the simple push button seen next to the tickler coupling handle. At the top center are two binding posts marked "DETECTOR" to which an external crystal detector is connected. The usual stopping condenser employed with the crystal detector is seen next to the secondary inductance switch, and is a fixed condenser with four taps. The best value of the stopping condenser for operation is secured by cutting out or in sufficient sections of this condenser by means of the sectional switch until best results are obtained. Directly between secondary inductance and secondary condenser and to the right of them is the Signal Control Switch. It has five positions, and only moves through an arc of 90 degrees to make these five connections. These five positions are marked on the Control Switch nameplate, and are: (1) SEND. (2) RECEIVE CRYSTAL TUNED. (3) CRYSTAL UNTUNED. (4) RECEIVE AUDION TUNED. (5) UNTUNED. The contact springs are extra heavy and

At the extreme right, along the entire length of the receiver, are a series of binding posts, connections from which are made to the Control Switch just described. Each pair of binding posts has a nameplate which fully describes its function and connections. The design has been built to enable connection to be made to the standard Audion Control Boxes, which carry binding posts marked exactly as on the receiver, thus facilitating proper connection.

Practically all the switches, knobs, dials, binding posts and so on are standard parts, which are always in stock, can be bought, or readily made, in any quantity with tools and fixtures already at hand in the modern shop. Of those parts that are not standard, almost all can be made by stamping. Thus the design is such as to enable rapid quantity production economically.

In the design of this set, care was taken to provide a sufficient overlap in the wave-lengths of the different scale ranges so that the end waves on the scales could be repeated at the beginning of the scale on the next range. The following tables are given, as of interest in showing the overlap obtained in this set.

PRIMARY CIRCUIT

Tap	10	180	Condenser Degrees
A	200	350	Wave-length Meters
B	270	528	" " "
C	340	680	" " "
D			
E		1390	" " "
F	1200	2050	" " "
G	1850	3230	" " "

SECONDARY CIRCUIT

Tap	10	180	Condenser Degrees
I	240	630	Wave-length Meters
II	380	1125	" " "
III	625	1800	" " "
IV	1120	3400	" " "

Photos by courtesy of General Electric Co.

Radio Digest

(*Continued from page 392*)

five or six years has specialized almost entirely on radio telephone matters. There is no one in our Engineering Department who has individually contributed more to the success of our various undertakings in the radio field since 1914 than Mr. Heising, and the action of the Institute of Radio Engineers is a just tribute to him."

Soon after he entered the radio research field in 1915, Mr. Heising was connected with the Montauk-Wilmington-Washington wireless experiments and later the Paris-Arlington tests. During the war he was engaged in the development of circuits for aeroplane and submarine chaser wireless sets. Recently, his studies have been devoted to the perfection of radio systems for extending Bell Telephone Service to locations which cannot be reached by wire.

Club Gossip

(*Continued from page 405*)

PENN RAIDO CLUB

The first meeting this season of the Penn Radio Club was held on Thursday, Sept. 15, 1921, at 7.30 P.M., at the home of our treasurer, Mr. O. G. Albert, 667 N. Preston St., West Philadelphia.

While waiting for the members to arrive, some of the time was devoted to listening in on a two-step amplifier to several radiophone concerts.

The president, Mr. Robert Littler, gave a speech on the purposes and objects of the club. Under the heading of "General Business" the date for the election of the officers, the dues, and a better place for headquarters, were discussed.

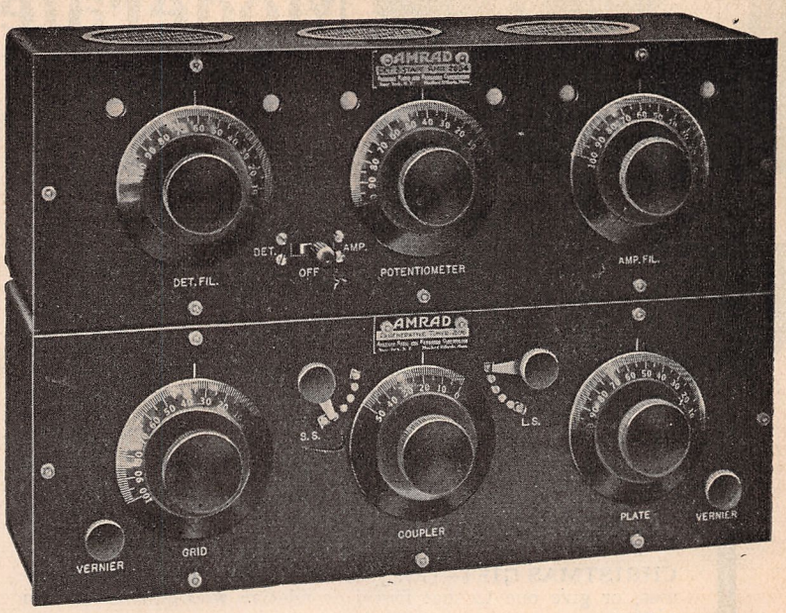
All business having been taken care of, the remainder of the evening was spent in listening in.

Fellow bugs, one of the main objects of this club is code practice; if you are interested please come forward.

LeRoy Ritter, secretary, 2415 S. Sartain St., Philadelphia, Pa.

AMRAD

The Recognized Symbol of Superior Performance



New Quality Receiving Units

In Solid Mahogany Cabinets

(1) Back Connections hidden from View—
(2) Non-mechanical Vernier Controls which hunt down the wary C.W.—
(3) Unit Construction allowing economical expansion of the set—
(4) Compact and new designs which increase efficiency, minimize space and reduce weight—
(5) Quality appearance due to rich mahogany cabinets with rounded corners, glossy-black beveled dials, finished panels, brilliant white engraving, modern aluminum frame construction, etc.

These are some of the features which make these Quality Receiving Units absolutely unequalled for modern short wave receiving.

No. 2596 is a Short-Wave Regenerative Tuner with Vernier Controls.

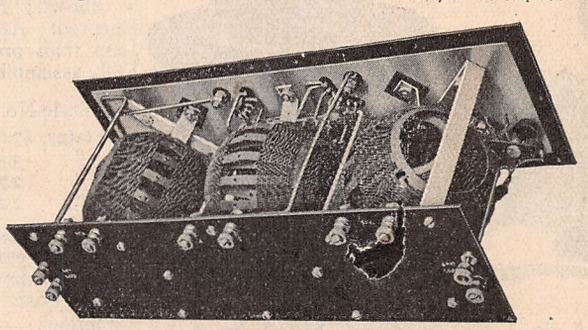
Price $45.00.

No. 2634 is a Detector 2-Stage Amplifier including two celebrated Amrad Ampliformers (Amplifying Transformers)

Price $47.50.

In combination these two units give a high class receiving station, as illustrated above, of unquestionable efficiency and quality.

Write for descriptive Bulletin L.



Interior of Regenerative Tuner, No. 2596, showing Basket-weave Variometers and Vario-Coupler. Wave-length range 180-350 meters. Amrad Adjustable Load Coil increases wave-range to 3000 meters.

Twin-R Synchronous Motor endorsed by leading amateurs described in Bulletin T. Price only $25.00

Amrad Receiving Specialties described in Bulletin N should be investigated by every up-to-date operator. Order now from your dealer to insure Christmas delivery.

Amrad Catalog listing 85 items—the most complete line on the market—sent for 10 cents in stamps.

SPECIAL:—Stranded Copper Antenna Wire, No. 24—7 Strands Twisted—125 ft. to coil—From our Terminated War Contract—Only 50 cents.

AMERICAN RADIO AND RESEARCH CORPORATION

203 College Avenue

Medford Hillside, Massachusetts

(*Suburb of Boston*)

New York City
15 Park Row

Chicago, Illinois
600 South Dearborn St.

BRANDES
Matched-Tone
HEADSETS

Moderate Prices

The moderate prices of the Brandes Headsets enable all operators to become owners. They give everyone a chance to have the best equipment instead of the ordinary and often unsatisfactory kind. They allow you to install extra headsets when necessary. Three Kinds:

"Navy" type—most sensitive $14.00
"Trans-Atlantic"—the professional type 12.00
"Superior"—the supersensitive amateur headset 8.00

Sold on 10 days' trial. Money refunded if not satisfactory.

CHRISTMAS GIFT—Give yourself a Brandes Headset for Christmas, or give one to that friend or relative who is interested in wireless.

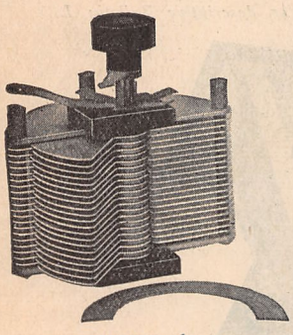
Send 5c for Catalog G

DEALERS—Write for Proposition

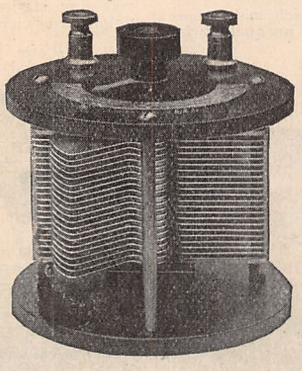
C. BRANDES, INC.
Wireless Headset Specialist
Room 823, 32 Union Square, New York City

"ILLINOIS" THE RELIABLE

MADE RIGHT - STAYS RIGHT



STYLE No. 1



STYLE No. 2

Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3, Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

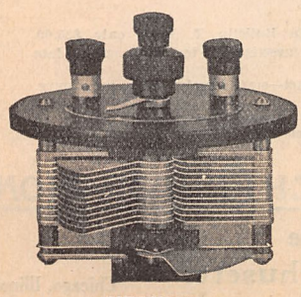
Style No.	1	2	3
67 Plates,	$7.00	$8.00	$8.50
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

Options:—With Style No. 1—instead of Scale and Pointer, a 3-inch Metal Dial at 50 cents extra, or a 3-inch Bakelite Dial at $1.00 extra. Large Knobs. Both excellent values. Or we will, if desired, supply the Condenser with smooth 3-16 inch center staff, without Scale, Knob and Pointer, at 15 cents off the list to those who prefer to supply their own dial.

Vernier with single movable plate applied to 13, 23 or 43 plate condenser, $3.00 extra.

We allow no discounts except 5 percent on orders of 6 or more.



VERNIER

Sent Prepaid on Receipt of Price

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c.

Foreign Orders other than Canada not solicited.

G. F. JOHNSON, 625 Black Ave., Springfield, Illinois.

THE FIRST SURINAM RADIO ASSOCIATION

Our association is quite a young body, established under legal charter, with the object of furnishing its members, who must be either radio amateurs or student, the best means of keeping in touch with all the most recent inventions, reading and study on wireless.

It is part of our policy, in seeking to obtain the results aimed at, to establish friendly relation with associations and clubs of a similar nature, and we wish to co-operate mutually in behalf of our members. We invite correspondence from American clubs and would be glad to communicate with them. D. A. Nunes, P. O. Box 145, Paramaribo, Surinam, Dutch Guiana, South America.

High Voltage Dynamos

(Continued from page 408)

Paper, white writing	200- 275	225	9,000
Paraffined Paper	800-1,000	900	36,000
Silk, Single Covering (on wires)	350- 565	475	19,000
Silk, Single Covering, shellacked	500- 575	525	21,000
Silk, Double Covering	320- 420	375	15,000
Silk, Double Covering, shellacked	420- 510	450	18,000
Wood, Mahogany	10- 25	15	600
Wood, Pine	5- 20	10	400
Wood, Walnut...	15- 40	20	800

Inland Castaways

(Continued from page 399)

startling in its simplicity. I felt ashamed of myself for not thinking of it sooner. Me, a radio amateur at that!

"Doc!" I yelled, as he and Rudd moved down the hill, "come back!—I have an idea!"

"Impossible," he called sarcastically, but nevertheless returned to the fire. "What is it?"

"Let me take the spark coils from the car, and the storage battery, then everybody come with me to the house."

"What are you going to do?" they persisted. I explained that the wires between the house and barn would serve as an excellent aerial, and with the coils and battery, it might be possible, in view of our elevation to reach some amateur at home.

The idea was not received with enthusiasm by the ladies, for the abandoned buildings presented a cheerless aspect in the gathering dusk. But Doc approved, and we journeyed once more to the house.

It was but a moment's work to remove the phone from the wall, and connect the coils and battery. A strip of tomato can furnished a key. Two rusty nails driven into a dry piece of wood furnished the spark gap.

The question of a ground was puzzling, until I remembered that a length of wire led into the inside of the barn. This lead was cut off at the outside insulators, taken to the house, and run from the coil to the pump in the kitchen; it was more than long enough.

I felt quite pleased with myself.

"This is all very well," said Doc, "but how are you going to know that anyone hears your message? We can't exist on hope."

Well, I was stumped. Then the telephone, now reposing on the dry batteries in the corner, caught my eye.

"Control yourselves, me friends," says I, "and hand me yon telephone."

They did as requested, and I proceeded to dismember the instrument. From the ringer I took enough wire for two small coils, placed one on top of the other, and hoped it would be a loose-coupler. Then two tin-can covers separated by a sheet of paper

—Who Enjoys Your Set?

Do you? Of course, *but,* think what sport it would be to discard those awkward, tiresome, and uncomfortable head sets, do away with them entirely, and get everything loud and clear all over the place.

And wouldn't it be great to treat your friends and neighbors to a radio music concert whenever you felt like it, or let them all enjoy hearing the news events of the world as you pick them up by wireless?

And you can—with the Radio MAGNAVOX—do all this and more, easily and inexpensively. Ask your dealer about this marvelous wonder instrument, or write us direct. Do it *now,* and make your set the source and center of enjoyment it should be.

The Radio MAGNAVOX

A beautiful and efficient outfit, made in two sizes. Type R-2 uses ½ ampere in field, Type R-3, 1 ampere. Any amount of current can be used without distorting signals or injuring apparatus. Any one can operate the MAGNAVOX. Price complete as illustrated, Type R-3, $45.

Type R-2 with 22 in. horn $110

At your dealer or direct from factory.

Send for FREE card—

illustrating and describing the hook-up and operation of the Radio MAGNAVOX and the famous "moveable coil" which makes it so efficient. This interesting card free—send for it NOW.

Dealers—write for proposition.

General Offices and Factory

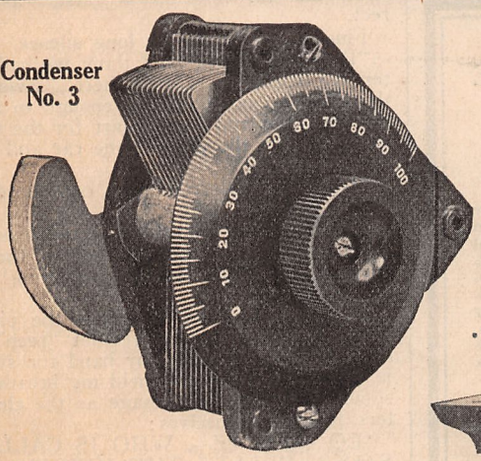
OAKLAND, CALIFORNIA

New York Office
370 Seventh Ave.—Penn. Terminal Bldg.

CHELSEA

Variable Condensers

(Die-Cast Type)



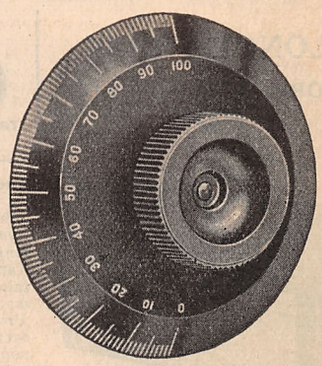
No. 1.—.0011 m. f. mounted.....$5.00
No. 2.—.0006 m. f. mounted..... 4.50
No. 3.—.0011 m. f. unmounted..... 4.75
No. 3.—.0011 m. f. unmounted, without dial 4.35
No. 4.—.0006 m. f. unmounted..... 4.25
No. 4.—.0006 m. f. unmounted, without dial 3.85

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates.

Unmounted types will fit any panel and are equipped with counterweight.

Purchase from your dealer; if he does not carry it, send to us.

NO. 50 PRICE AS SHOWN, $4.50



"CHELSEA" BAKELITE DIAL NO. 41.

The Chelsea dials are made of genuine bakelite, beautifully finished, and bear a 100 division semi-circular scale.

The dial is 3¼ inches in diameter, ¼ inch thick, with a long, sloping, easily read marking. Chelsea bakelite dials run true and will not warp.

The complete dial and knob is made to fit either 3/16, ¼ or 5/16 inch shaft. Specify size when ordering, otherwise the ¼ inch hole will be furnished.

Chelsea dials are beautiful in appearance low in price accurate and durable in service, unexcelled by any, at any price.

Dial and knob complete.....$1.00

Purchase from your dealer.

The Chelsea Amplifying Transformer is a supreme attainment in the design of Audio Frequency Transformers. It embodies the highest grade of materials obtainable and proper design, which reflects the result attained namely high amplification factor. It is unequalled either in electrical characteristics or good appearance.

CHELSEA RADIO CO., 150 Fifth Street, Chelsea, Mass.

Manufacturers of Radio Apparatus and Moulders of Bakelite

Everything

The new branches—arcs and tubes—of the revised examination of the Department of Commerce are fully covered in the Home Study Course of the Radio Institute of America.

Enrollments are coming in by every mail. Why aren't you one of the wide-awake wireless men who have seen the new and greater opportunity opened to them by the Home Study Course, which is specially designed to land them one of the enviable jobs at the world's greatest radio station?

It will be equipped to work simultaneously with five other nations in widely separated and distant parts of the world.

A position at this station is the height of every operator's ambition, for it means unlimited opportunity to succeed and progress to higher, more responsible and better paying positions in the radio industry. So far as opportunity goes the successful future of these men is assured.

How about you?

The graduates of the Radio Institute of America enjoy a great and exclusive advantage in the close connection existing between the Institute and the Radio Corporation of America, the world's largest radio manufacturing and commercial radio company.

Prominent executives in the radio field are former students of the Institute. The Radio Corporation employs thousands of men, in its executive departments, on ships and at shore stations and in factories and laboratories. A large percentage of these men are graduates of the Institute.

The Radio Institute of America has been an established and successful institution for over fifteen years. It has trained over 6,000 men, 95% of whom have successfully engaged in this new branch of science and industry.

Write for our booklet and further details—*Now.*

HOME STUDY DIVISION

Radio Institute *of* America

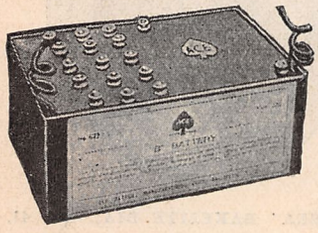
(formerly Marconi Institute)

324 Broadway, New York

LONGER LIFE
MORE THAN A TRADE MARK

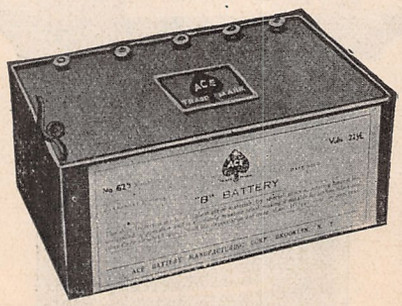
ACE TRADE MARK

BETTER SERVICE
A SIGN OF "B" BATTERY QUALITY



The new "Ace" No. 627-45 Volt Variable "B" Battery is rapidly creating a remarkable reputation as to "Price," Quality, Service and Weight. The special size cell construction guarantees from 50% to 75% longer life than any 2 small size "B" Batteries. 16 Taps, 30 Voltage readings of from 1½ to 45 Volts obtained. Absolutely the best "B" Battery offer ever made. Size 6 in. x 5 in. x 2⅜ in.—weight 3¾ lbs. Price $3.50. Demand "ACE." If your dealer does not carry "Ace," write to us. This list contains the six popular type "ACE" "B" Batteries.

Cat. No.		Size	Voltage	Lbs.	Taps.	Price
623	Plain	2½x2x3⅜	22½	1		$1.50
623	Variable	2½x2x3⅜	22½	1	5	1.75
625	Plain	3 x4x6⅝	22½	5		2.50
625	Variable	3 x4x6⅝	22½	5	5	3.00
626	Plain	3 x8x6⅝	45	10		5.00
626	Variable	3 x8x6⅝	45	10	6	6.00



Write for Catalog No. 20

Ace Batteries are silent, moisture proof and absolutely guaranteed.

DEALERS—Get in on this fast selling item.

44 Court Street ACE BATTERY MFG. CORP. Brooklyn, N. Y.

NOTICE! **4th DISTRICT AMATEURS** ***NOTICE!***

Southern Radio Supply Co. now ready to fill your wants. Mail orders shipped same day received.
Complete Stock: Remler, Murdock, Acme, Federal, DeForest, Clapp-Eastham and Amrad apparatus.
Formica sheets and tubes, Ace B batteries, RAC 3 Audions, $3.50; receptacles $1.00 postpaid; Cunningham Detectors, amplifiers and power tubes.

We carry a complete line of CW apparatus.

SOUTHERN RADIO SUPPLY CO. **CLEARWATER, FLORIDA**

became a condenser. The receiver was connected in, and—oh! what a sinking feeling—where was the detector?

On that bare hill top were no crystals, and if they did exist it was now too dark to look for any.

"For the love-o'-Mike, man, make haste," said Doc impatiently, "pretty soon it will be too dark to see anything."

The others crowded closer to the window, and concentrating all my scattered faculties I thought rapidly over the list of known wave rectifiers. For a despairing moment I was about to admit defeat, then it came to me. Why not utilize the carbons of the lightning arrester for a microphone detector? The ancient batteries on the floor would furnish the minute local current necessary.

Hastily I bent the ends of two carbons into a V-shape, borrowed a pin from one of the girls, straightened it, scraped it bright, laid it across the carbons, and then connected in the dry cells. The receiving circuit was complete. Nothing suggested itself for an aerial switch, so connections were changed by hand.

"All right," I announced, smiling with an assurance I did not feel, "now we'll call up Jamesburg."

It was a strange scene. The spark flared and flickered, casting grotesque shadows upon the dilapidated walls. In its weird blue light, the faces of my little audience stood out tense and ghost-like from the surrounding darkness. One of the girls exclaimed in fright; outside, the black shroud of night cloaked the mountains with its sable mantle, and the wind, increasing in velocity, moaned dismally through the forests. It required no stretch of imagination to picture serious consequences to what had promised to be merely a delightful adventure. The girls were plainly unstrung, and one of them shivered incessantly.

For an hour I alternately called "S.O.S." and strained my ear for reply, but none came. Static muttered spasmodically, so I knew that my hook-up, at least, was correct.

Finally Doc broke the long silence.

"Brownee," he said, "I think we had better not spend more time here. Evidently the coils are not powerful enough to reach anyone. Jim and I will start for the town, and you take the girls to the car and keep the fire going."

"Doc," I implored, "just one more try before you go."

Changing the connections, I called again; a long slow call, then shifted to the receiving and prayed for an answering note. But none came.

Acting on impulse I stirred the pin on the carbons. Instantly a faint "peep" became audible. Raising my hand for silence in the room, I literally held my breath and slowly penciled the message as the characters formed themselves:

"CQ CQ de 8Z—, WHO IS CALLING S.O.S.? WHAT'S THE JOKE?"

Feverishly I changed the aerial to the sending set and answered:

"8Z— 8Z— 8Z— de CB CB CB. THIS IS AUTO PARTY STRANDED IN MOUNTAINS 15 MILES FROM LEESVILLE. SEND HELP. FOLLOW LEESVILLE ROAD AND WATCH FOR SIGNAL FIRE FROM HILL. BRING GASOLINE. HURRY."

Then I clutched the receiver to my ear for the reply and hoped fervently that the microphone had not been knocked out again.

Fainter than before the call came.

Apparently my dry batteries had given up their last electron, but it mattered not. The answer was short:

"CB CB de 8Z— O.K. COMING IMMEDIATELY—8Z—."

With a profound sigh of relief I sank back against the wall and tried to answer the clamor of questions. When it finally became clear to the party that help was on the way, the "atmosphere" changed as if by magic. Everyone rushed joyously back

Condensite celoron

Makes Good Radio Equipment Better

Insulation is the foundation of all radio. Your equipment can only be as efficient as the insulation you use in its construction. Condensite Celoron is the safest, surest and most successful answer. There are seven salient reasons why.

Condensite Celoron is high in resistivity and dielectric strength, extremely water resistant, immune to atmospheric and climatic conditions, insoluble, infusible, long-lasting and attractive. Read this Bureau of Standard test:

Diamond-F

Wave Length Meters	Approximate Frequency Cycles per Second	Phase Difference Degrees	Dielectric Constant—K
373	804,000	2.0	4.7
1,295	231,500	1.8	4.8
3,067	97,800	1.8	4.9

We supply this remarkable material in standard size sheets, rods and tubes ready for all machining purposes—for experts and amateurs. Sold by radio equipment dealers everywhere. If your dealer cannot supply you, write us.

Diamond State Fibre Company

Bridgeport (near Philadelphia), Penna.

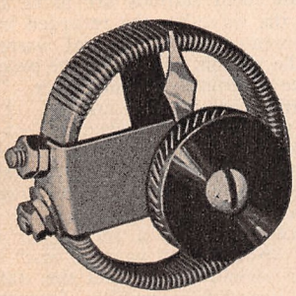
Branch Factory and Warehouse, Chicago
Offices in Principal Cities

In Canada, Diamond State Fibre Co. of Canada, Ltd., Toronto

Do you want lower prices on radio apparatus

without sacrificing quality? Then purchase WILCOX Products. We believe that the low prices given below will increase our sales ten times. Unless they do we will lose. If they do the saving resulting from increased production will repay us. We are depending on you to support our attempt to lower prices and we ask you not to fail us. Send in your order now.

WILCOX TYPE 122 RHEOSTAT



PRICE NOW

65c

POSTPAID

(WAS 90c)

Panel mounting—1.5 amp. for receiving tubes or 3 amp. for transmitters—Strong self-supporting resistance unit with every inch exposed for cooling—Brass panel bushing and bearing make it very smooth running—Easy to mount—All off position provided—Requires panel space only two inches in diameter—Now furnished with new style WILCOX knob, better looking than the one shown—All exposed metal parts nickel-plated.

This rheostat, we originally planned to sell for one dollar but we took a chance and offered it for ninety cents and were rewarded by immense sales. We are now taking a bigger chance and have reduced the price to sixty-five cents. This makes it cost much less than any other rheostat and less than half as much as any which can compare with it in quality.

WILCOX REGENERATIVE RECEIVER PARTS

PRICE **$13.50** POSTPAID

This set of parts contains absolutely everything necessary to make a complete regenerative short wave receiver that will equal any in performance and appearance; and the best part of it is that both rotors and stators of variometers and variocoupler are completely wound and the panel comes already drilled so that the hard part is all done for you. It is only necessary to assemble the variometers and variocoupler, fasten them to the panel and wire them up.

All wooden parts are accurately turned from genuine mahogany. The rotors are true sections of spheres and have hollow centers. The one piece brass shafts are provided with tubular bearings and pigtailed connections to the rotors do away with the noise bound to result from sliding contacts. Two switches are provided which allow an adjustment of one turn on the primary.

The various parts have been carefully designed to operate properly together and the instructions furnished are so complete and the assembly work so easy that any amateur can complete the set at home and have an instrument equal to any at less than one fourth the usual cost.

LIST OF PARTS FURNISHED

1 Bakelite-dilecto panel (drilled)	2 Panel Switches
2 Complete sets variometer parts (wound)	14 Switch Points
1 Set variocoupler parts (wound)	4 Switch Stops
2 Type 117 dial, large graduated 0-100	3 Dial Pointers
1 Type 117 dial, small graduated 0-50	6 Binding Posts

ALL EXPOSED METAL PARTS NICKLE PLATED

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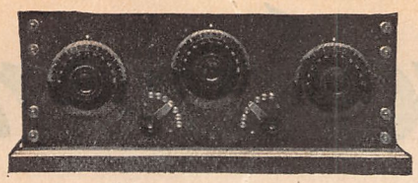

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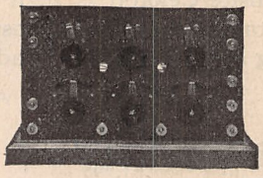

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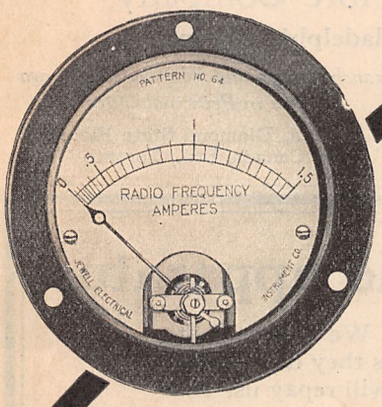

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to the car, the coils and battery were replaced, the lights turned on and stacks of fuel heaped upon the dying fire.

As the flames soared upward with renewed life, songs were sung, jokes and stories came forth and once more it was a gay old world.

Some time later. two tiny lights were discerned moving far down the valley; at times they disappeared. Finally they came closer. At last we heard the chugging of a car ascending a grade, and then a big machine rolled to a stop beside us.

Two young fellows jumped out. Explanations were made and soon we were homeward bound.

One of the young fellows was the amateur who heard my call. His station was located in the village and my first signals had come in clearly, but thinking it some spark coil amateur perpetrating a joke he paid no attention. An hour later, tuning on the same wave-length, he again heard the call, and fortunately answered.

Of course I was the hero of the hour, and as a tired but happy auto party entered the outskirts of Jamesburg, Doc observed cheerfully:

"Well, I guess a telephone may be of some value after all!"

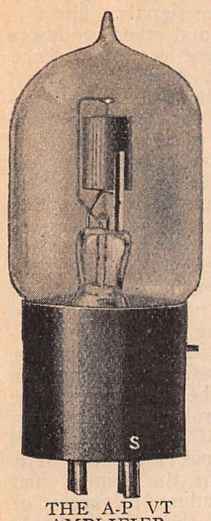
The Meeting of the Technical Committee on International Radio Communication

(*Continued from page* 393)

waves of which the amplitude or frequency is varied by the operation of keying in telegraph transmission; A2—Continuous waves in which the amplitude of frequency is varied in a periodic manner at an audible frequency; A3—Continuous waves in which the amplitude or frequency is varied according to the characteristic vibrations of speech type B—Damped waves, consisting of successive wave trains in which the amplitude of the oscillations, after reaching its maximum declines gradually. In defining these types of waves, the technical committee makes it clear that no reference is made to types of transmitting apparatus. For instance, emissions from spark equipment which yield real continuous waves are not barred from type A1. Similarly, spark apparatus, producing real modulated continuous waves, are not excluded from type A2. In practice, the principle prescribes that the emissions of fixed stations are to be made exactly on the wave-lengths recorded in the Central Bureau as the normal wave or waves of the station. To quote the proceedings of the international committee: "The Administrations responsible should fix the allowable tolerance for departures of the mean frequency from the given value and should take advantage of the progress of the art to reduce this tolerance progressively. In the case where bands of frequencies are allotted to a service, or to a station, or to different nations, each Administration should ensure that the stations under its jurisdiction employ frequencies which are sufficiently far removed from the limits of these bands, in order that no objectionable amount of interference be caused to traffic of other services or stations employing frequencies outside the bands." With respect to each type, the waves were classified according to the degree of interference they produce at any distance. Each nation is left free to choose the best means for determining whether a particular emission may be accepted in any type or class of waves. The elimination of the use of waves of inferior classes is urged upon all the nations. No restrictions were placed on the sending of distress signals.

Question number two inquired whether in practice the use by mobile services of the 700-meter damped wave is apt to interfere

use A-P tubes for efficiency



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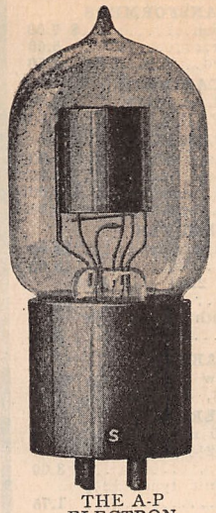

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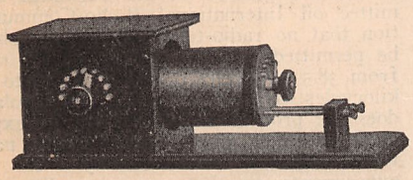
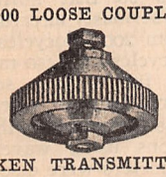
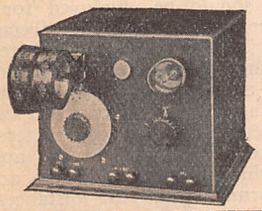


L-100 LOOSE COUPLER



SKINDERVIKEN TRANSMITTER BUTTON



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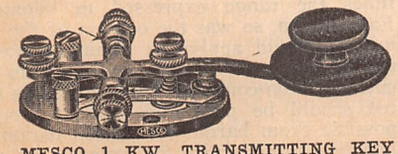

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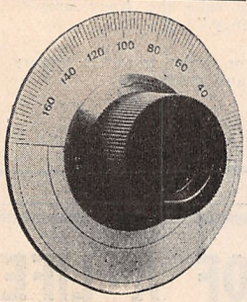

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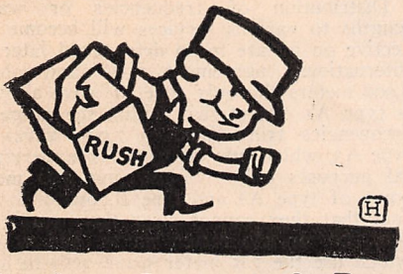
with the 600 and 800 meter waves, and if so, how much. The conclusion is that the 429 kilocycles (700 meter) will interfere with the reception of continuous wave signals. Also, there is liable to be interference in the use of 700 meters with the reception of 375 kilocycles (800 meters) and 500 kilocycles (600 meters) wave signals. The ty of apparatus, distances, and other conditions will influence the degree of interference. The committee did not, however, deem it expedient to prohibit the use of the 700-meter damped wave. Only certain restrictions were imposed. It was the wish of the committee that until a date was fixed by the next International Conference on Electrical Communications that time signals, weather bulletins and warnings to navigators be transmitted on damped waves. After the fixing of the date referred to above, the 600-meter wave will not be employed for such signals save those used by mobile and land stations for sending telegrams of urgency involving the safety of navigators. Wave-lengths allotted to the transmission of regular traffic will be used in sending time-signals and meteorological telegrams. Also, a damped wave of 2,650 meters will be provided as additional facilities. The Paris conference was of the opinion that the exact time of sending messages of weather observations and time-signals should be specified by international agreement. It was not considered advisable, owing to the progress of radiotelegraphy and radiotelephony, to define specific privileges for each type or class of wave.

The outstanding claim of the American delegation that certain bands of waves should be reserved for radiotelephony prevailed. It was recommended that the wave-lengths 880 kilocycles (340 m.) to 1,000 kilocycles (300 m.) shall be used for radiotelephony (Type A3), and continuous waves (Type A1) for mobile services. The frequency of 725 meters was selected for use by mobile services, certain restrictions being stipulated. The range of frequency from 182.5 kilocycles (1,550 meters) to 193.5 kilocycles (1,550 meters) to 200 kilocycles (1,500 meters) was selected for aircraft services, both commercial and military. It was the decision of the Technical Committee on International Radio-Communication that no radio-telephony service should be permitted, for the present, in the range from 38.5 kilocycles or 8,000 meters to 42.9 kilocycles or 7,000 meters. This regulation does not prohibit the conducting of experiments between these limits. Each nation will restrict the hours employed for such experiments so that normal radio-service will not be seriously interrupted. The wave-lengths from 200 kilocycles or 1,500 meters to 207 kilocycles or 1,450 meters are allotted specifically for military services, and will not be shared by mobile services.

Principles governing the operation of fixed stations using waves between 3,050 and 30,000 meters were discussed and recommendations offered. The lower frequency waves should be employed for the longer distances while the higher frequency waves should be used for the shorter distances. For ranges below 4,000 kilometers no wave-length above 12,000 meters should be used. For ranges in excess of 4,000 kilometers, no wave-length below 8,000 meters should be employed. A guide to the application of this principle is found in the acceptance of the formula that for distances exceeding 1,500 kilometers the wave-lengths employed, expressed in meters, should not exceed three times the range expressed in kilometers. Each nation, so was the opinion of the committee, should apply the minimum possible number of wave-lengths necessary to execute its radio-communications. Waves emitted should be pure and uniform, free as possible from harmonics. Each nation was left free to determine the range of its ships, aircraft or coast stations by calculations based on measurements of the electromagnetic field at a distance from the station greater than one wave-length as well as by

practical daylight signalling tests.

The range of mobile radio-beacons, so declared the technical committee, shall not exceed ten nautical miles. The normal distance of short-range fixed radio-beacons shall be restricted to a maximum of thirty nautical miles, while the extent of a long-range fixed radio-beacon shall be confined to two hundred nautical miles. Waves of Type A1 only should be employed. The Paris meeting considered the subject of wave-lengths to be employed by radio direction finders, with reference to which of these waves are more desirable, namely, 450, 600 or 800 meters. Also the question was asked whether all radio direction-finding stations should be prepared to receive signals for bearings on both 450 and 800 meters. The conclusions are: Bearings may



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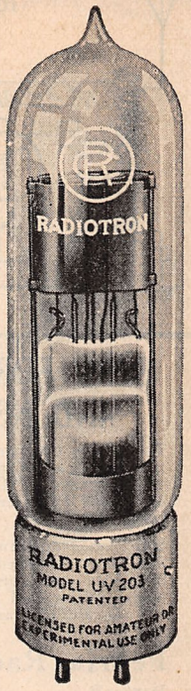

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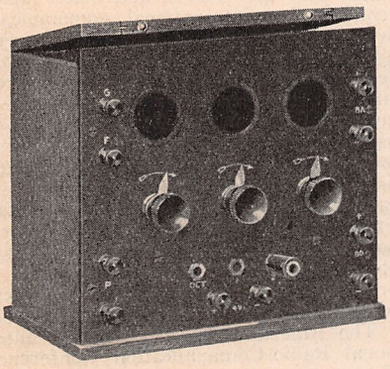

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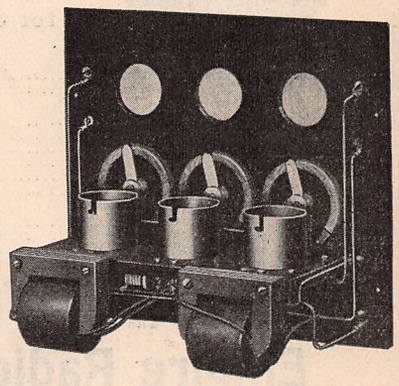

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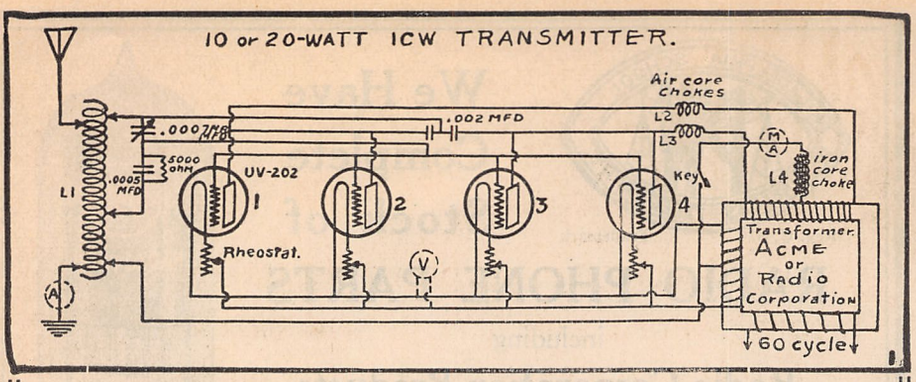

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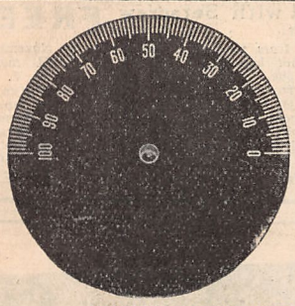
Keep posted on new prices and equipment. Owing to our connection with the largest manufacturers, some of whom we represent exclusively, we are prepared to offer dealers a real advantage in price and delivery. If you are a Dealer, write at once for our new trade schedules. Get your name on our mailing list for latest information on prices and equipment.

Klaus Radio Company
Dept. 200, EUREKA, ILL.



ONE EMPIRE DIAL FREE

With Every Two Dollar Order

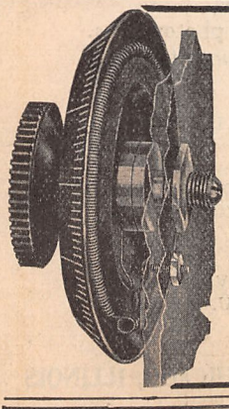
Due to the great demand for our free dial offer, we are extending this offer for the month of November.

VARIABLE CONDENSERS	
Chelsea .0006 for panel mounting	$4.25
Chelsea .0011 for panel mounting	4.75
DIALS	
Chelsea 3" dial	1.00
Paragon 2¼" rheostat dial	.90
Paragon 3" dial	1.00
Paragon 4" dial	1.75
Tuska 4" dial	1.50
Empire 2¼" dial	.25
VACUUM TUBES	
Radiotron U.V.200 detector tube	5.00
Radiotron U.V.201 amplifier tube	6.50
Radiotron U.V.202 5 watt power tube	8.00
Audiotron double filament	6.00
VARIOMETERS AND VARIOCOUPLERS	
Empire variometer	6.00
Empire variocoupler	5.50
Tuska moulded variometer with dial	7.25
RHEOSTATS	
Remler	1.00
Fada	1.25
Paragon	1.50
"B" BATTERIES	
Cyclone 22½ volt (small)	1.00
Cyclone 22½ volt (large)	2.00
Cyclone 45 volt (large size variable)	4.00
Eveready 22½ volt (large variable)	3.00
Turney short wave regenerative tuner	5.00
Paragon socket	1.00
Tuska C.W. inductance	3.75
Empire series—parallel switch	.85
Acme amplifying transformers (mounted)	5.00
Remler detector panel	8.00
Remler amplifier panel	6.00

Empire Radio Equipment Co.

Manufacturers and Distributors of Radio Apparatus

271 West 125th Street New York City



WE USED OUR BEAN in designing

THE PARKIN DIAL TYPE RHEOSTAT (Pat. pending) and by mounting the resistance element in a circular groove in the back of a 3" molded Bakelite dial eliminated one part and saved you the cost of a dial. The groove being recessed, allows the dial to clear the panel by the usual distance of 1/16". An off position is provided and a stop on the dial engages the stationary contact at the extreme positions. The 360 degree rotation insures fine adjustment. A brass bearing insures a true running dial and smooth action.
All figures and graduations are filled with brilliant white enamel. All brass parts nickel plated. Bakelite knob.
Resistance is 5 ohms, carrying capacity 2 amps. No. 77 Parkin Dial Type Rheostat Postpaid, $1.75.

FOR SALE BY ALL LEADING DEALERS

Send for free catalog No. 5 describing our complete line. Dealers Write for proposition.

PARKIN MFG. CO. SAN RAFAEL, CALIF.

A welcome addition to your library! Send $2.50 today, plus postage for 7 lbs., and your copy of bound volume No. 2 of Radio News will come forward by return mail.
Experimenter Publishing Company, Inc. 236a Fulton Street, New York City

be given to mobile stations by radiogoniometric coast-stations on 375 kilocycles (800 meters), and 667 kilocycles (450 meters). For regular service, radiogoniometric coast-stations must be equipped to give bearings to mobile stations on one of the frequencies or one of the group of frequencies given herewith: Three hundred and seventy-five kilocycles (800 meters) only, or 500 kilocycles (600 meters) and 667 kilocycles (450 meters), or 375 kilocycles (800 meters) and 667 kilocycles (450 m.). As an emergency measure in the interest of aiding mobile stations in distress or danger, all radiogoniometric coast-stations which do not employ the frequency of 500 kilocycles or 600 meters must be able to take bearings on that wave-length. The subject of spacing of waves, owing to the sparsity of information, was not broached by the committee.

Distribution of frequencies or wave-lengths to various services will become effective on a date to be determined later by international agreement. At and above 5,000 meters the only type of wave allowed is type A1 except that within the range of frequencies from 8,000 to 7,000 waves of type A3, which may be used for experimental purposes only. Ships using 700 meter wave of type A2 and type B, owing to the fact that they cannot clear their traffic on 800, 600, or 450 meter waves, and vessels which use the 725 meter wave, will be subject to this ruling: "It shall be left to the land station to decide whether the 725 or 700 meter wave shall be used; this shall only be in cases where its use will not interfere with other traffic."

Any nation may authorize the use of frequencies in excess of 200 meter waves of any class in any way, including amateurs, provided these stipulations are met: Must not disturb the working of the international service of mobile stations using frequencies of 220 meters and above; shall not molest the operation of radio communications of any other nation on 250 meters and above. This does not include the use of the plain aerial. The Technical Committee contemplates that 200 meters and below may be required for international communications over shorter distances, and that it may necessitate the formulation of international regulations as to their use. It is deemed desirable that after January 1, 1923, the frequency of 300 meters, Type B, shall not be used. Type B may be employed on wave-lengths greater than 1,500 meters allotted to fixed services, provided interference is not caused to any service of any other nation. Stations now using damped waves for important Government messages and weather-observation telegrams may continue the practice until a date is fixed by the next International Conference prohibiting same.

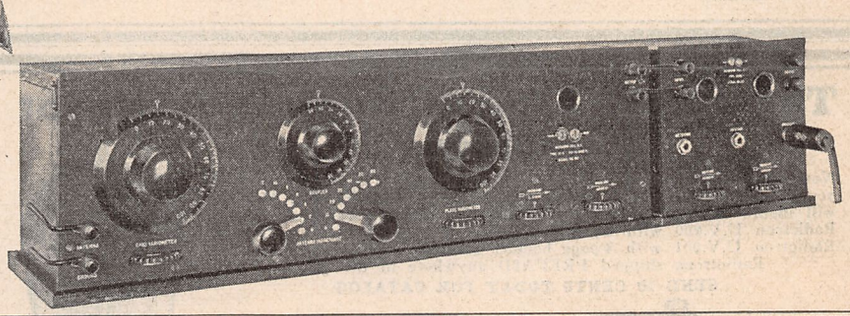
The American delegation to the International Radio-Communication Conference in Paris was composed of Major General George Squier, Chief Signal Officer of the United States Army, Chairman, representing the State Department; Rear Admiral Thomas F. Magruder, Naval Attache of the United States Navy at Paris; Dr. J. H. Dellinger, Chief of the Radio Laboratory, Bureau of Standards, United States Department of Commerce; Lieutenant-Commander Edward H. Loftin, of the Bureau of Engineering, United States Navy Department; Dr. L. W. Austin, Head of the Research Laboratory of the Navy Department; Dr. Louis Cohen, Consulting Engineer of the Signal Corps, United States Army; Major J. O. Mauborgne, of the Signal Corps; F. P. Guthrie, of the Radio Division, United States Shipping Board; Dr. A. E. Kennelly, Professor in Harvard University and Massachusetts Institute of Technology, who was Secretary of the Delegation.

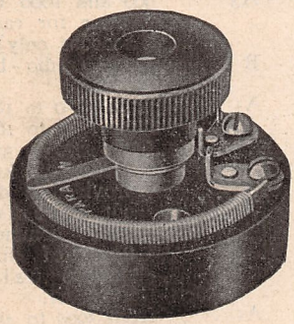
DISTRIBUTION OF WAVE-LENGTHS TO VARIOUS SERVICES—MOBILE SERVICES

Meters		
200 to 550	A1	from 200 to 550.
	A2	from 230 to 300.
		from 340 to 550.

A man without thought for the future — must soon have present sorrow-
Think of the coming clear cold nights and buy that Grebe Receiver Now!

Doctor Thu





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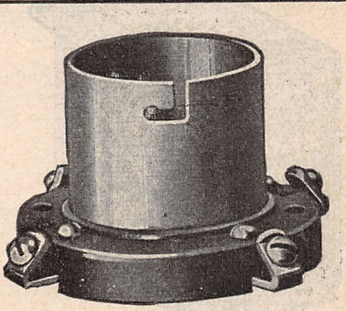
MEANS
"PERFECT MODEL OF EXCELLENCE"

AND IT IS FOUND ONLY ON

RECEIVERS	RADIOFONES
AMPLIFIERS	SOCKETS
DETECTORS	KNOBS
V. T. CONTROLS	VARIOMETERS
CONDENSERS	SWITCHES
RHEOSTATS	DIALS, ETC.



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ADAMS-MORGAN CO.

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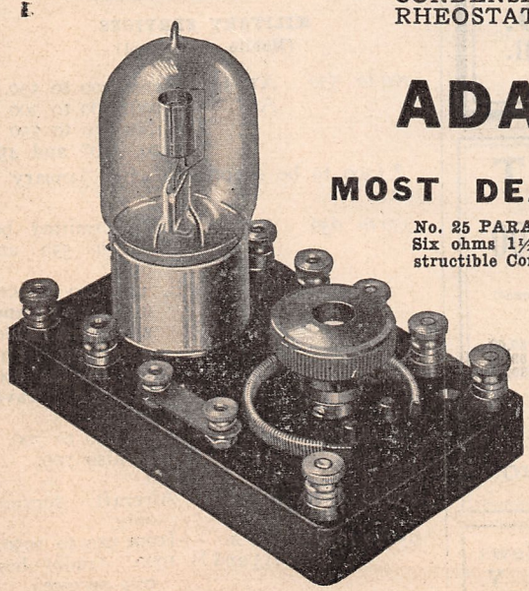
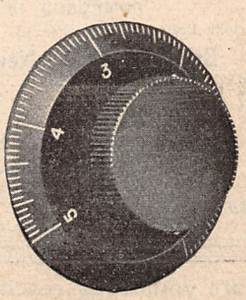


No. 25 PARAGON RHEOSTAT $1.50.
Six ohms 1½ amps. max. Either panel or table mounting. Indestructible Condensite base. Highest grade on the market.

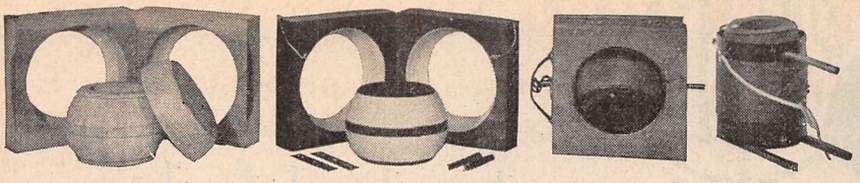
No. 30 PARAGON SOCKET $1.00.
A *real* socket at a *right* price. Highly polished nickel shell and Condensite base. Indestructible. Laminated springs give smooth firm contact.

No. 70 VT CONTROL $6.00.
Strictly high grade instrument. Does better work than many high priced cabinets. Finely finished indestructible Condensite panel embraces socket, rheostat, condenser, leak and nine terminals. Metal parts polished nickel.

WE'VE A DIAL FOR EVERY PURPOSE
and they all match. Cut shows 270 degree dial for our rheo. and potentiometer. Superb finish. Indestructible. Fits ¼ inch shaft. Price 90c. Moulded of Condensite.



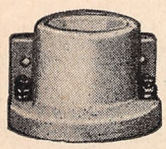
SHORT WAVE EFFICIENCY!



Can only be had by using variometers which are scientifically constructed. The market is full of variometers more or less indifferently designed which are built solely to sell without a true appreciation of what is necessary in their construction. Consult any authority and he will tell you that you can tune with either capacity or inductance, BUT that inductance is preferable. Then think it over and see if you will buy moulded variometers (the better the dielectric the more capacity) or whether you will buy "CINO." Over five hundred sets in use today, and on the market only six months!

Variometer parts only **$2.50**
Variometer wound, not assembled.... **4.50**
Variometers complete plate or grid.. **6.00**
Variocoupler parts only **$2.50**
Variocoupler wound, not assembled... **4.50**
Variocoupler complete **6.50**
CROSLEY PORCELAIN SOCKET ..... **$ .60**

Your dealer has them



Cino Radio Mfg. Co.
218 West 12th Street
Cincinnati Ohio

CINO

The "QSA" Line of Radio Equipment
Radiotrons

Now that long distance transmission and reception is being resumed, you'll need a more highly efficient station. A RADIOTRON U.V.200 will insure MAXIMUM EFFICIENCY for your receiving set.
Radiotron U.V.200 with 4-page booklet of instructions..... **$5.00**
Radiotron U.V.201 with 4-page booklet of instructions..... **6.50**
Radiotrons shipped PREPAID anywhere in the U. S.
SEND 10 CENTS TODAY FOR CATALOG.

COMBAT

A storage battery for radio work should be designed for that work. In the "COMBAT" you have a strong yet durable battery. Several patented features make it especially recommendable for radio work. The only battery with non-corroding terminals. Special introductory offer of 30% off list expires Nov. 30th. Write NOW for "COMBAT" circular and prices.

While They Last 45 V. "B" Batteries $1.85 each

INDEPENDENT RADIO SUPPLY CO.
3716 W. Douglas Blvd. Dept. R-11 Chicago, Ill.
"Better Results with Less Effort."

QST QST QST

$1.00 PER COIL 200 FEET AEROPLANE ANTENNA WIRE PER COIL 200 FEET $1.00
COMPOSED 16 STRANDS NO. 30 BARE COPPER, BRAIDED
(Include Postage on One Pound) (Dealers Write for Discount)

Baldwin Phones, New Prices
Type C **$13.75**
Type E **15.00**
Type F **16.25**

Grebe Apparatus, New Models
CR5 Super-Special, 150-300 meters..... **80.00**
CR8 150-1000 meters, with detector unit..... **80.00**
CR9 150-3000 meters, detector and 2 step..... **130.00**

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	A3	from 300 to 340 and 525.
	B	220, 300* and 450.

* (300 to be suppressed after January 1, 1923.)

550 to 650	A1	not permitted between 550 and 650.
	A2, 3 and B,	use 600 meters in accordance with rules regarding the use of the 600-meter wave.
650 to 850	A1	from 650 to 850.
	A2	from 650 to 750 and 800.
	A3	725.
	B	700 and 800.
850 to 950	A1, 2, 3	from 850 to 950 (Aircraft services only).
	B	not permitted.
950 to 1050	A1, 2	from 950 to 1050.
	A3	1000 (for radio-beacons) and 960.
	B	1000 (for radio-beacons).
1500 to 1550	A1, 2, 3	from 1500 to 1550 (Aircraft services only).
	A3	1580, provided it does not interfere with communications of fixed stations using Type A1.
2100 to 2650	A1	from 2100 to 2650. (2400 A1, for calling only.)
	A3	from 2500 to 2650.
4800 to 5000	A1	from 4800 to 5000.

FIXED SERVICES

Meters		
200 to 280	A1, 2	from 200 to 280.
	A3	from 200 to 230.
950 to 1050	A1, 2	from 950 to 1050.
	A3	960 and 1000 (the latter for radio-beacons only).
	B	1000 (radio-beacons).
1550 to 1850	A1	from 1550 to 1850.
	A2 and 3	from 1550 to 1650.
2850 to 3300	A1	from 2850 to 3300. A band of 8 kc/s. provided it does not interfere with communications of fixed stations using Type A1.
3900 to 4800	A1	from 3900 to 4800.

MILITARY SERVICES
(Mobile and Fixed)

200 to 550	A1, 3	from 200 to 550.
	A2	from 200 to 300. from 340 to 550. 220, 300* and 450.

* (300 to be suppressed after January 1, 1923.)

550 to 650	A1	not permitted between 550 and 650.
	A2, 3 and B,	use 600 meters in accordance with the rules regarding the use of the 600-meter wavelength.
650 to 700	A1	from 650 to 700.
	A2	675—also 700.
	B	700.
850 to 950	A1, 2, 3,	Aircraft services only.
950 to 1050	A1, 2	from 950 to 1050.
	A3 and B	1000 (radio-beacon service).
1050 to 1500	A1, 2, 3	Aircraft services

Atlas Radio Products—for Efficiency

Why You Should Buy Atlas Radio Products

UNMOUNTED **MOUNTED**

Popular opinion has demanded that really efficient amplifying, modulation, filament heating and C.W. power transformers be put on the market and made available to the amateur. The great majority of these instruments on the market heretofore, were highly inefficient, and have had a power factor in the neighborhood of 50%. ATLAS transformers will henceforth be rated on output, and will use double windings, larger windings, larger wire and larger cores in order that the power factor be as high as possible. This is being done at 100% increase in cost of production, but the selling price of the instruments will not be changed.

GUARANTEE: Run an efficiency test with any other transformer on the market and determine its power factor; then run the same test with Atlas transformers, and if they do not prove more efficient your money will be refunded upon request.

ATLAS AMPLIFYING TRANSFORMERS

Mounted	$ 5.00
Semi-mounted	4.00
Unmounted	3.50
Parts for same—	
Primary and secondary	2.50
Core	1.00
Four aluminum legs	.50
Panel and binding posts	1.00

ATLAS CW TRANSFORMERS
Plate Transformers, 500 Watt, 1000-1500 Volts

Mounted	$24.00
Semi-mounted	22.00
Unmounted	19.00
Parts for same—	
Complete windings	15.00
Core	4.00
Supporting legs	3.00
Panel and binding posts	2.00

ATLAS CW CHOKE COILS 1½ Henry 500 M.A.

Double Semi-mounted	$ 7.50
Single semi-mounted	5.50
Unmounted, double	6.00
Unmounted, single	4.00
Parts for same—	
Coils, each	2.00
Core	2.00
Supporting legs	1.50

ATLAS CW POWER TRANSFORMERS
200 Watt, Secondary 350 and 550 Volts, Filament Winding 12 Volts Variable

Mounted	$19.00
Semi-mounted	17.00
Unmounted	15.00
Parts for same—	
Complete windings	12.00
Core	3.00
Supporting legs	2.00
Panel and binding posts	2.00

ATLAS FILAMENT HEATING TRANSFORMERS
75 Watt, Filament Voltage 8-10

Mounted	$11.00
Semi-mounted	10.00
Unmounted	8.50
Parts for same—	
Complete windings	5.00
Core	3.50
Supporting legs	1.50
Panel and binding posts	1.00

ATLAS CW TUNING INDUCTANCES
6 Inch Formica Tubes No. 8 Enameled Wire

25 turn inductance	$ 8.00
30 turn inductance	9.00
45 turn inductance	10.00

ATLAS CW POWER TRANSFORMERS
50 Watt, Secondary 375 Volts, Filament Windings, 10 V. Variable

Mounted	$14.00
Semi-mounted	13.00
Unmounted	11.00
Parts for same—	
Complete windings	9.00
Core	2.00
Supporting legs	2.00
Panel and binding posts	1.00

ATLAS RECEIVING AND POWER TUBE RHEOSTATS

6 ohm 1.5 ampere for receiving tubes	$ 1.00
6 ohm 7 ampere for 5 to 50 watt power tubes	2.00
4 ohm 16 ampere for 50 to 250 watt power tubes	5.00

ATLAS SPECIAL RHEOSTATS FOR CONSTANT VOLTAGE CONTROL OF POWER TUBES

50 ohm 3 ampere at 110 volts for primary control of 5 watt power tubes	$ 5.00
50 ohm 7 amperes at 110 volts for primary control of 50 watt power tubes	10.00
50 ohm 15 ampere at 110 volts for primary control of 250 watt power tubes	15.00

Prices quoted on other sizes on request.

ATLAS MODULATION TRANSFORMERS

Mounted	$ 5.00
Semi-mounted	4.00
Unmounted	3.50
Parts for same—	
Primary and secondary	2.50
Core	1.00
Four supporting legs	.50
Panel and binding posts	1.00

ATLAS FILAMENT HEATING TRANSFORMERS
150 Watt Filament Voltage 10-12

Mounted	$16.00
Semi-mounted	14.00
Unmounted	12.00
Parts for same—	
Complete windings	8.00
Core	4.00
Supporting legs	2.00
Panel and binding posts	2.00

ATLAS CW CHOKE COILS
1½ Henry 150 M.A.

Double, semi-mounted	$ 5.50
Single, semi-mounted	4.00
Double, unmounted	4.50
Single, unmounted	3.00
Parts for same—	
Coils, each	1.50
Core	1.50
Supporting legs	1.00

ATLAS DX-52 SUPER OSCILLATION TRANSFORMER $25.00

Special sorted, tested & Guaranteed Vacuum tubes, all makes, at list prices

AMATEURS: Send 10 cents for ATLAS Catalogue
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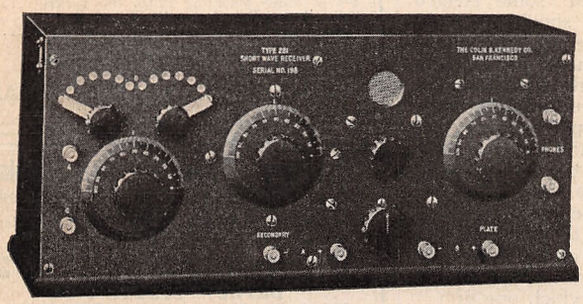
THE AMERICAN RADIO SALES & SERVICE CO., Mansfield, Ohio, U. S. A.



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Our new improved Type 281

SHORT WAVE REGENERATIVE RECEIVER

is designed for high efficiency on wave lengths of 185 to 620 meters.

The ideal set for relay work. It embodies all the features of correct design and superior workmanship that have established the reputation of Kennedy Equipment.

You will be interested in the details of this new short wave set. Ask your dealer about it. If he cannot supply you we will send you Bulletin 201 on request.

The high quality of Kennedy apparatus is being appreciated by those who want the best results.

We again find it necessary to greatly increase our factory capacity to meet the demand

THE COLIN B. KENNEDY COMPANY
INCORPORATED
RIALTO BUILDING SAN FRANCISCO

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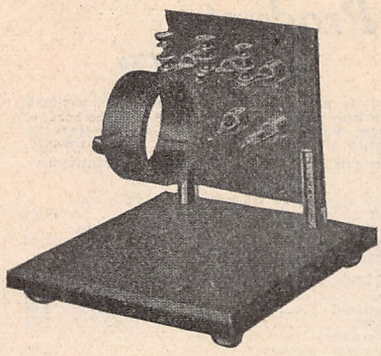
WIXICO



COIL MOUNTING

Pat. applied for

and bring your set up-to-date.

WRITE FOR PARTICULARS

Table Type, made to order only	$8.00
Panel Type	5.00
Wixico Clips	4.00
Plugs	.70

Above does not include coils. Plugs fit only WIXICO Mounting but are sold separately if desired.

See your dealer or write us.

We also handle a complete line of Radio apparatus. Send 4 cents for our catalog. Write us your wants.

THE AMOLECCO CO.
CINCINNATI, OHIO

Wireless Amateurs
ATTENTION!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

SPECIAL!

Vacuum Tube Sockets	$1.25
Rheostats	1.25
22½ Volt "B" Batteries	1.50
Rasco Dials	.60
Rubber Binding Posts	.20
Tested Galena	.40
Lateral Wound Coils. All sizes.	

Send 5c for our large illustrated catalog.

J. M. PAQUIN
THE ELECTRICAL SHOP
787 QUEEN ST. WEST
TORONTO, ONT.

AN UNUSUAL RADIO CATALOG FREE. CRAIG & LOUGHBOROUGH NORWOOD (CINCINNATI) OHIO

Lower Economy Radio Prices

$3.00 Black fiber 7x20x¼ Panels, now each	$2.00
.02½ per square inch, cut to size, now sq. in.	$0.01½
Plate Batteries Ersco 22½V	$2.00
Plate Batteries Ersco 36V	3.20

"Always Something doing"

ECONOMY RADIO SUPPLIES CO.
232 Sanford St., East Orange, N. J.

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DODGE'S INSTITUTE, D Street, Valparaiso, Ind.

1850 to 2100	A1, 2, 3	
2400	A1	for calling only.
2650 to 2850	A1, 2, 3	
3300 to 3900	A1, 2, 3	
4800 to 5000	A1	

Note: Military fixed stations may employ waves allotted to fixed services at the discretion of their Government, and when they do so, they will enjoy the same privileges as other fixed stations using similar waves.

SPECIAL SERVICES

Meters	
450	Radiogoniometric Service A2, 3 and B.
550 to 599	Reserved to protect distress wave. No types permitted.
600	Calling and distress wave. May also be used for radiogoniometric service A2, 3 and B.
601 to 650	Reserved to protect distress wave. No types permitted.
800	Radiogoniometric Service A2, 3 and B.
1000	Mobile radio-beacons, 10 nautical miles (18.5 km.), A1, 2, 3 and B. Short-range fixed radio-beacons 30 nautical miles (55.5 km.), A1, 2, 3 and B. Long-range fixed radio-beacons, 200 nautical miles (370 km.), A1.
2100	Radiogoniometric Service A1.
2400	Calling wave A1, for mobile and military services only.
2650	Time, meteorological, notices to mariners, etc., A1, 2 and B.

Junior Radio Course

(*Continued from page* 402)

during the time of the contact between the segment and the brush; if it is desired to close permanently a circuit, some electro magnets, acting as relays, should be used with, fixed to the armature, an interrupter of the same type as those used in the lamp sockets operated with a little chain, which when pulled, closes the circuit the first time and opens it at the second pull.

A complete circuit for the control of a ship is shown in Fig. 3. As may be seen the distributor connects the various relays, one after the other, in the circuit of the battery B2, which operates them if the contact R of the main relay is closed under the action of a signal sent from the sending station. In order to know which one of t relays is in circuit at any time, a special system may be used and consists of lamps differently colored installed in the mast of the ship, each color corresponding to a certain control, and enabling the operator of the sending station to know when to press the key to operate one or the other of the relays. The circuit of these lamps is closed by another distributor mounted on the same shaft as the main one.

If, for instance, it is desired in the case of a ship controlled by radio, to start the motor running the propeller, the operator presses the key when he sees the red flash in the mast of the ship, indicating that the proper relay is in circuit. The armature of the relay R2, then closes the switch C1 and the motor runs as long as another signal operates the same relay which opens the circuit of the motor. To steer the ship to right or left, two extra electro magnets are used and a common armature to which the rudder is fixed is attracteed by either one of them when the local circuit of the relays R3 or R4 is closed. If the key is pressed when the blue lamp glows, the relay R3 pulls the switch C2, closing the circuit of the battery B4; the armature moving the rudder is attracted by the upper electromagnet and the rudder is moved to the right. If another signal is sent when the blue lamp glows again, the switch C2

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1623 Variable	2½x2x3⅜	5	22½	1 lb.	1.20
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1625 Variable	3 x4x6⅝	5	22½	5 lbs.	2.25
1626 Plain	3 x8x6⅝		45	10 lbs.	3.75
1626 Variable	3 x8x6⅝	6	45	10 lbs.	4.15

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opens the circuit and the armature, released, comes back to normal position pulled by the springs attached to it. In steering the ship to the left, the same thing happens, but is controlled when the white lamp glows. At last, a gun may be fired automatically if a signal is sent when the green lamp is lit up, showing that the relay R5 closing the circuit of a spark coil lighting the powder is connected to the distributor.

Of course, any number of controls may be operated if the distributor is equipped with more segments, but the explanation given in this lesson is merely to show the principle of operation of this early system of radio control devised by Professor Branly. In the next lesson, we shall describe some other systems, which were used recently.

Basket-Wound Coils for Your Tuner

(*Continued from page 396*)

results. After this is done, the ends should be soldered.

For the benefit of those who do not have the details of the tuner I described in the May, 1921, issue of RADIO NEWS, I will state that the primary coil is shunted with a .001 mfd. variable condenser, the secondary coil is connected likewise, and the tickler coil is in series with the plate, without a shunt condenser.

Large coils, similar to those described above, have been constructed, using built-up wood forms. I found them to be remarkably efficient, in some cases better than honeycombs, but the disadvantage is in the size. I had them up to 18″ in diameter and in every case found them efficient, and in the case of the smaller ones, they have no rivals in efficiency.

A Simplified Type of Variable Condenser

(*Continued from page 396*)

wire soldered to plate 7 as shown and another piece, not visible, is soldered to plate 11 and connected to the other binding post.

The design of this set allows a very high capacity at the upper end of the scale and low at the lower end. The capacity is distributed over a scale of 180 degrees. When assembling, care should be taken to see that plate 11 is positively insulated from plate 7 and that piece 9 is soldered in the slot of rod 8 and bent so that plate 7 will slide up on it when lowered or raised.

The pointer 3 should point to 0° on the scale when plate 7 is down and to 180° when up to the highest point. A condenser like this, made well, will repay the time employed in the making.

FONE FUN.

By GEORGE SUTTON

Hello! Hello! Hello! Hello! Hello! Hello! Hello!
It's "XYZ" is calling on his telephone Radio,
I hope you get me clearly on this inset microphone,
I hope you get me, "XYZ," I hope you like my tone.

I'll try another microphone; how do you get me now?
The generator at my side makes such a fearful row,
The telephones upon my head are adding to the din,
I've got a splitting headache, but I hope you're listening in.

I'll put you on a record, I've arranged my gramaphone
So that should you get no music you can get the scratchy tone,

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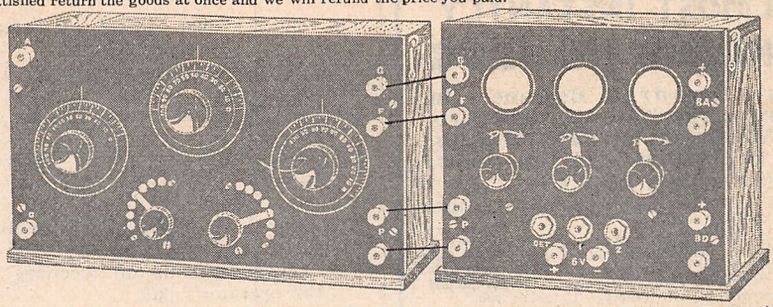

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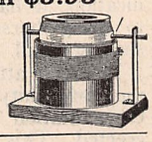
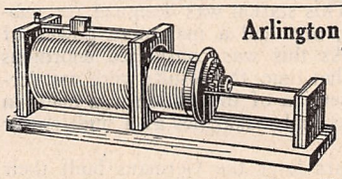
Perfect in design and construction. Accurate wood forms. Correct induction ratios. Solid baked windings. Positive circuit contacts. Highest efficiency. Will operate perfectly indefinitely. Make your own regenerative set and save money.

Loose Coupler, Each $3.95

With this loose coupler and two variometers together with the necessary other parts a highly efficient regenerative set can be made. Easily mounted on panel. Five taps of five turns each and five taps of two turns each. Windings on formica tubes. Inductively coupled for 180 to 600 meters.





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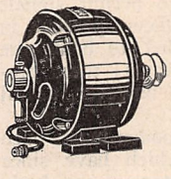
A high grade double receiver set. Complete with adjustable head band and five foot connecting cord. Very sensitive. 2,000 ohm resistance.



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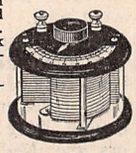

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Capacity .001 M. F. Each $4.05
Capacity .0005 M. F. Each $3.60

Standard 43 and 23 plate condensers. Aluminum plates accurately spaced. Permanent, high efficiency. Complete with knob and dial. Also supplied for panel mounting. State which is desired.

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A very sensitive instrument. Signals that cannot be heard with detector will be brought in strong. Has one detector and two amplifying circuits. Standard tube sockets, grid condenser in detector circuit, two amplifying transformers, 3 jacks and a plug. Satin finished Formica Panel. Fine Mahogany finished large size cabinet. Hinged top. Interior easily accessible. Binding posts for all necessary connections.

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Standard Brands.

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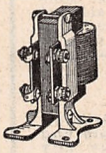

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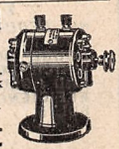

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It isn't quite like Melba's song, at Chelmsford long ago;
I hope you get me, "XYZ." Hello! Hello! Hello!

I'm changing over, "XYZ," to listen in and see
If you have got my message, or I'm jamming A.B.C.
I'm on a thousand meters, like the Cunarders at sea,
Be sure and answer, "XYZ," reply at once to me.

The switch is thrown, the motor slows to just a lingering wail,
The valves light up on receiving set and the operator's pale;
The amplifier howls as loud as a disappointed witch,
For the message hadn't gone at all, he'd forgotten his aerial switch.

Wireless Development in Holland

By J. G. de Regt

Although Holland was at one time one of the leading countries in wireless communication, it has taken a long time for her to bring herself back again to the place she once had.

The first attempt to introduce wireless in the community was made in 1904, when the Coast station at Scheveningen Harbor was erected. This station was designed for public service, and had a maximum power of 10 k.w. As this was considered enormous power at that time, the results were wonderful, and mention of the station was made in many books and magazines as a high power one.

Two years later the Germans built their first 10-k.w. power station at Nauen, and Scheveningen Harbor established communication with a nearby light vessel, after the well-known but almost forgotten Branly system. The Queen of the Netherlands personally attended a demonstration on board one of the Batavia Channel steamers. Preparations were made to permit signals being sent by one of the officers present, in case the Coast station failed, to bring the receiving apparatus into action; these precautions were unnecessary, however, as all went well.

Scheveningen had two wooden masts each 240' high at that time, which have since been replaced by two steel towers 300' high. The receiving and sending apparatus, of course, have been modernized, valve receivers are used and it is one of the best and most efficient coast stations of Europe; the stations at Amsterdam, Denhelder and Flushing were erected about the same time, under the control of the Navy.

These arrangements continued until the War broke out, when Holland seemed to lose her interest in wireless communication, although two months previous she had given her amateurs a free hand as far as reception was concerned, but the bill was soon suspended. The amateurs became so enthusiastic that they could not be held back, and even installed indoor antennae in order to receive far distant stations.

The Army used four auto stations, which were dismantled soon after their trial tests, and also installed three land stations, two of which were demolished within a very short time. The secret indoor antennae operated by amateurs were used constantly to intercept messages sent out by the Army stations and many sets were made to receive messages from the stations at the front, and to fix the location of the German directional senders.

In many cases indoor antennae were dis-

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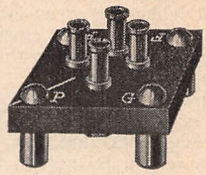

Insert tube prongs in slotted pins and you get a contact surface of ⅜" x ¼" positive and permanent. Fused with new type fuse on each filament and plate lead. You can't

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1¼" screws at corners for mounting and connecting. ¼" machined Bakelite base. Lettered and filled with white as shown. N. P. screws and supports. The price is $1.00 by mail post paid, and it's worth it. This socket fused for filament protection only. If you want to mount your own, pins only 10 cents each. Extra fuses new copper mica type, 10 cents each. State tube.
SPECIAL 3 SOCKET MOUNTING. Lettered for leads and det, 1-Amp., 2-Amp., on ¼" machined base. Fused of course. A well made beautiful unit just the thing for det and 2 step Amp., 7½" by 2¼" overall, postpaid, $4.50.
Three contact plug. Mounted in bakelite. Offset type. You can't insert wrong. Use 3 slotted pins for jacks. Fine for 6-40 volt control. $1.00 postpaid. Fuse block with any desired capacity fuse (double), 50 cents P.P.

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3/16"	.03½	3/16"	.02½	3/16"	.01½
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⅜"	.07	⅜"	.05	⅜"	.03
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7 strand copper aerial wire, 75c per 100 ft., prepaid.

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covered by the police service, and the innocent victims were imprisoned for espionage. This was followed by freedom, eventually, of all amateurs, and high antennae were erected on the roofs of many houses, people became interested and newspapers installed their own sets, bank buildings erected receivers, jewelers took time signals and everywhere new manufacturers of wireless apparatus appeared. Enthusiasm spread all over the country and the wireless spirit was again awake. At the school house, special lectures were read on the subject, and were followed with interest by many of the students.

When the Armistice was signed, the Army had a station in the big cities, namely: Amsterdam, Haarlem, The Hague, Rotterdam, Hertogenbosch, Maastricht, Arnhem, Utrecht, Amersfoort, Zwolle, Assen, Groningen and Leeuwarden; these formed a close connection in case the Bolsheviki should destroy the telegraph lines. The Air Department erected continuous-wave transmitters at Shiphall, Soesterberg and De Mok, on one of the North Sea Islands; they also transmitted by Radiophone.

In 1920 the telegraph department of Holland installed two valve transmitters on its buildings at Amsterdam and Rotterdam, and these stations handle most of the ordinary traffic to and from Germany and Denmark. Until the beginning of 1921, the only weather reports were those sent by Scheveningen to ships at sea, followed by navigation warnings. For the farmer and others, these reports were of less value. Complete weather reports are now sent at low speed by Utrecht, and these are repeated by phone by the Amsterdam station. Forecastings of night frost are also reported by phone from Soesterberg.

During the time all the changes were taking place, work was going on without delay at the Kootwijk high power station, which must establish communication with the Far East. Six masts extend 620′ in the air, and are situated in a very lonely spot in the middle of an extensive and wild moor. Two years previous, this place was practically unknown, the untiring hunter being the only one who ventured in that desolate section of rough heather, but he now has to go elsewhere, for in the place where the endless purple heather grew in all its beauty and brightness as far as the eye could reach, there now stand buildings and houses forming a complete town. The railroad found its way there and the whole country is cultivated and crossed by roads and paths.

The receiving station, which is also in the middle of a large moor, has been in active service for about a year and many important messages have been received there, and all this wireless activity is going on within the limits of a small country of a few square miles only.

Amateur Radio on Prince Edward Island

By Walter Hyndman, IAT

Having seen very little in the radio magazines about amateur radio in Canada, I thought a description of conditions on "Spud Island" might interest you.

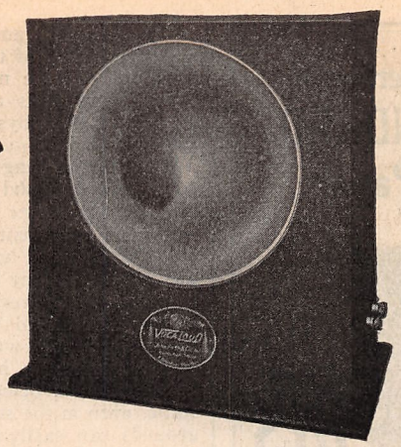
Owing to existing Government restrictions, little sending is attempted, but things are not as bad as some of you imagine.

Charlottetown, the capital city, has several good amateur stations, a club, and a radio school.

The Navy League here is conducting a radio class in connection with the Navigation School, which is proving very popular.

Of the stations, the most important are 9AK, owned and operated by Major Keith Rogers, C.S.C., and the one installed at the

Station Type
In handsome mahogany cabinet, as shown.
$30.00



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THE IDEAL loud-speaker. Requires no batteries, no adjustments, no extra equipment whatever. Just hook VOCALOUD right on to your receiving apparatus and listen to your signals, —QSA *all over your house!* Uses genuine Baldwin reproducer,—equally good for telephone and telegraph. Your order shipped at once!

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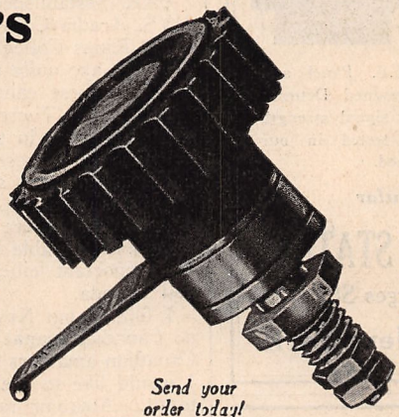

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PRICE: 90 cents, Postage, 5 cents.

Composition knob, identical with knobs used on standard No. 67 Corwin Dial. Brass shaft is moulded right into knob — *it can never come loose.* Blade, bushings, etc., nickel-plated brass. Contact radius, 1¾ inch.

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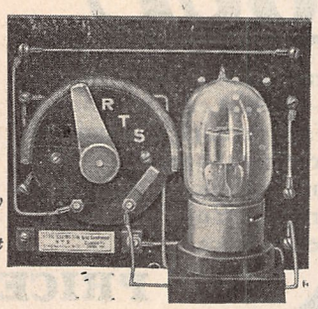

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12 x 18 x 3/16 in.	3.85

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UV-201 Amplifier	6.50
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ATTENTION!

Our STORAGE "B" BATTERIES give years of service without expert attention, saving you REAL money in the end. One charge lasts from three to six months in the detector plate circuit. All batteries shipped complete with rectifiers and full Directions.

Plain batteries with clips for adjustment at the following prices: 32 volts, $8; 48 volts, $10; 68 volts, $12. With control panels 32 volts, $10; 48 volts, $12; 68 volts, $15. Satisfaction guaranteed or money refunded.

KIMLEY ELECTRIC CO.

290 Winslow Ave. Buffalo, N. Y.

Navy League, and operated by myself (XEN). Both of these stations have ½-k.w. transmitters (the maximum allowed), non-synchronous gaps and regenerative receivers. 9AK employs a Grebe two-step amplifier, and XEN a Clapp-Eastham two-step. We both have long-wave receivers, and can copy American and Continental arcs on one bulb. Last winter we greatly enjoyed the radio concerts sent out from Union College, which were heard all over the operating room. At my home station, I listened to the S. S. *Gloucester* (KQG) taking part in the "Ocean to Ocean" test, and heard him very clearly, without amplifier.

The climate up here is very suitable for wireless work, being remarkably free from static, even in the summer months, and good grounds can easily be obtained. There are no very high tension lines to worry about, and no trouble with Naval stations.

The only commercial station on the Island is at Cape Bear (VCP), about 50 miles from Charlottetown. There are of course numerous "hams" of the spark coil variety in the city, but our Club is looking after them. VCP is an old-fashioned station and uses a 10" coil for sending, and a crystal receiver.

We hear a great many American stations in Massachusetts, New York, and Pennsylvania. We have not covered any great distances with our transmitters as yet, but hope to do so next season.

9AK established communication with IWS, Acadia College, Wolfville, N. S., and IAO, Kings College, Windsor, N. S.

There are quite a few amateurs in Halifax, but these cannot send much, being so near VCS. There are a number of stations going up in the rural sections of this province, but these are confined to spark coils owing to the absence of A.C. power.

9AK is official A. R. R. L. station for this district, and there is no reason why we should not be able to have routes to any of the important cities in the United States and Canada.

I like RADIO NEWS fine, and as we have no Canadian magazine, and as a great many Canadian amateurs must read this magazine, I would like to see at least a page devoted to us. Amateur radio is booming in Canada, especially in Montreal and Toronto, and other large centers, although we see very little about what is being done.

CANADIANS, why not let each other know what we are doing? Work together and boost Radio. Let RADIO NEWS hear from you. They assure me they will be glad to help us, and will reserve space for a Canadian section, if sufficient material offers. Take advantage of the offer.

Fellows, some of these Yanks think we belong to the spark coil and crystal class; show them what we are made of.

We should get together and establish relay routes as soon as possible to be ready for next season. Now don't forget, let us hear from you soon.

Radio in New Zealand

By "Zealandia"

Commercial radio traffic in New Zealand is handled by the four Telefunken stations, Awanui (VLA), Auckland (VLD), Wellington (VLW) and Awarua (VLB). They are all controlled by the Post and Telegraph Department. The main station is Awanui, which is of 40-k.w. power. The aerial is of the umbrella type suspended from a single steel tower 400' high. The normal wavelengths used are 2,000 and 600 meters, but various other wave-lengths are provided for. Press sent by VLA on 2,000 meters has been copied by ship stations as far as 5,800 miles away, and has also been copied at Tucker-

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We sell complete sets or parts

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Northwest Radio Service Co.

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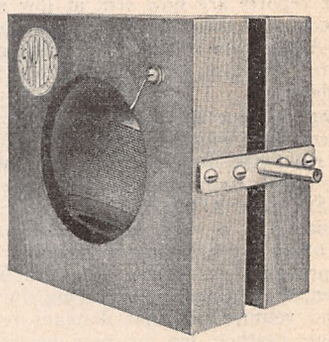
RADIO 7XC



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Variable Condseners, Transmitters, Head Bands, Panel Switches, Etc.

Connecticut Tel. & Elec. Co., Meriden, Conn.

ton, N. J. A duplicate of this station is situated at Awarua, in the South Island, but it is used mainly for 600 meters. Awanui handles traffic for Apia, Rarotonga, Tahiti and Nukualofa, all islands in the South Pacific.

The stations at Auckland and Wellington are used for ship traffic only, except in the case of Wellington, which exchanges traffic with Chatham Island (VLC), a small island 500 miles south-east of Wellington. The conditions for reception are very favorable, especially in the South. Most of the European stations are copied; a few of these are, YN, POZ, MUU, IDO, OUI, IQZ, FL, OSM (Constantinople) and OHD which I believe is somewhere in Austria. Only one valve is used in copying these stations, but experimental sets using up to seven valves have been tried with very good results. On a single wire aerial, with an average height of not more than 15′ and 300′ long and using one "soft" valve, I have copied YN, POZ, NSS and OUI, the three first in daylight.

Until about six months ago, no amateur stations were allowed to operate, but licenses are being granted now for receiving sets only. A Wireless Institute has been formed with branches in all the large towns and is doing good work in instructing amateurs and promoting an interest in Radio, which up to the present time has been killed by the Radio Laws. If transmitting licenses are granted, it will not be long before amateurs in Australia and New Zealand will be exchanging signals. Amateur stations fitted with C.W. apparatus would be able to communicate without much difficulty. That is, with stations around Adelaide, Melbourne and Sydney.

What is badly needed in Australasia is a good local Radio magazine. At present RADIO NEWS supplies all the requirements for development, improvement, etc., in the art, and if you could get regular contributions from these two Dominions, the Radio enthusiasts "down under" would appreciate, still more, your excellent publication.

We have not heard any of your Californian amateurs in New Zealand as yet, but hope to do so very soon.

RADIO A LA REPORTER.

Everybody knows the expression "where did he get that stuff?" This could be applied to the following article appearing in the Syracuse, N. Y., *Journal:*

WIRELESS WAVE LENGTHS

"The earth's maximum wave-length is 14,000 meters, and if the Martian's wave is 150,000 meters long, one can understand why we must speed up a little. The difference also shows the great difficulty Mr. Marconi is having in determining just what he thinks he has, and the likelihood of prolonged puzzlement, even if the two languages are identical."

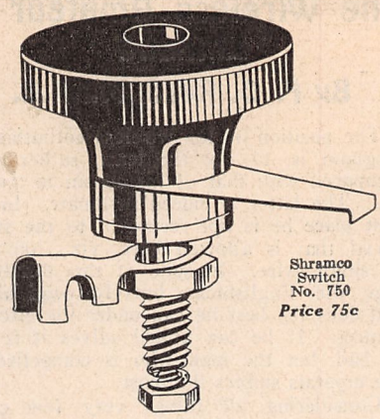
We offer a fur-lined rotary gap electrode for the best definition of the earth's wavelength and Martian's wave, and a formica grid for detector tube, to anyone who can tell us at what speed we should run to catch up the Martian waves!

In fact, it is a pity to see such things in print in newspapers, as this gives a wrong idea of Radio to the public. To suppose that the Martians speak English is a very improbable supposition, as we know that none of our Correspondence Schools have any students up there.

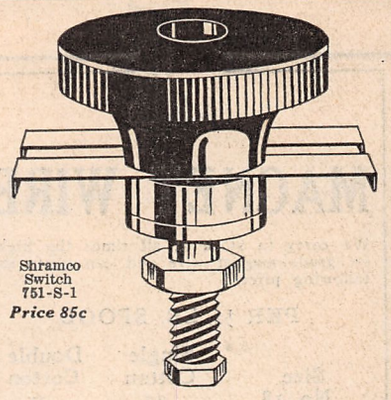
MORE THAN LIKELY.

"I wonder what those signals mean that Marconi says we are getting from Mars."

"Oh, they are probably trying to get us to join a League of Planets."



Shramco Switch No. 750 *Price 75c*



Shramco Switch 751-S-1 *Price 85c*

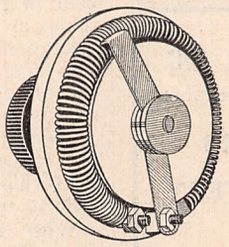
Two Shramco Switches

YOU CAN hardly afford to take chances of loosing efficiency by getting along with poor switches. Either of these two styles will distinguish itself by smooth operation and sure contacts, in addition to the handsome appearance. Both have polished nickel finish and are furnished with large Marconi type knob. Bearing block and panel bushing ¾″ in diameter. For use on all panels up to ½″ thick. Blades, spring phosphor bronze. No. 750 type has spring tension adjustment; switch radius, 1½″.

No. 751-S-1 type is provided with split lock nut; blades have 1″ radius, ½″ from center to center, and are securely held in place. If your dealer cannot supply you, send your order direct, postage extra. Dealers who have not a supply of Shramco switches should write for proposition at once.

For your VT detector, amplifier, and power tubes—

use the famous Shramco Reos, with "Nichrome" resistances. Type 90, 6 ohm resistance, for detectors and amplifiers, $2.00, plus postage for two pounds. Type 90P, the new Reo specially



designed for Radiotron U.V. 202, with 1.5 ohm resistance, $2.00, plus postage for one pound. Ask your radio dealer or send your order direct.

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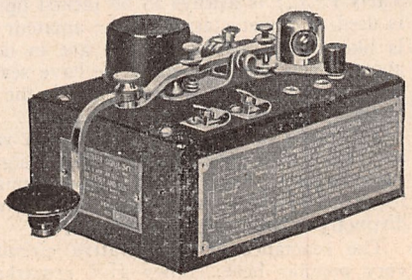

Of high grade construction, designed for the purpose of instruction in audible or visual signals, with the International or other codes based on the dot and dash principle. It is scientifically made for efficiency, simplicity, compactness and durability.

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A model of perfection and all-around utility, officially adopted by the U. S. Army Air Service, U. S. Marine Corps and Navy Department Bureau of Steam Engineering. It is a self-contained unit, and may be operated on the table, in the lap, or in any position desired. Note detachable arm.

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PER ¼ LB. SPOOL

Size	Single Cotton	Double Cotton
No. 18	.23	.25
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No. 24	.30	.33
No. 26	.33	.38
No. 28	.37	.41
No. 30	.49	.52
No. 32	.62	.65
No. 34	.89	.93
No. 36	1.21	1.30

For 1 lb., ½ lb. and ⅛th lb. spools, proportionate prices. These prices are net, include the cost of spool, postage and guaranteed safe delivery.

Aerial Copper Wire No. 14

Special at 60c per 100 ft.

Complete line of standard radio equipment always in stock. Write for our new catalogue, No. 2.

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DON'T READ THIS

IF YOU ARE A MILLIONAIRE

Magnet Wire per ½-lb. Spool

B&S Ga.	S.C.	S.S.	Enam.
20 to 24.....	$ .70	$ .95	$ .60
26 to 30.....	1.00	1.40	.70
32 to 36.....	1.50	2.20	.85

For 1-lb. spools add 75% to above prices.

Aerial Wire..100 ft.	250 ft.	500 ft.	1000 ft.
Stranded 7-22 $ .75	$1.80	$3.50	$6.90
No. 14 solid.. .50	1.15	2.00	3.75

WESCO Mounted Amplifying Transformers..$ 3.45
Detector Panels, Reg. Price $12.00..... 7.00
Amplifier Panels, Reg. Price $18.00..... .. 11.50
Bakelite ⅛" cut to size 1¾c per sq. inch.

Write for our new literature

Attractive proposition for dealers.

WILMINGTON ELECTRICAL SPECIALTY COMPANY

705 Adams St., Dept. R, WILMINGTON, DEL.

The Wireless Amateur in England

By F. O. Read, M.I.R.E.

The position of the wireless enthusiast in England is, to say the least, rather poor compared with that of his cousin in America. The latter is indeed fortunate. In the first place he is not restricted to the small aerial that is allowed here, viz., 100 feet of single wire. In spite of this disadvantage the Englishman bravely pegs along and does the best he can under the circumstances. If he can afford valves it is not so bad, but the man who is compelled to use crystals suffers the most.

Considering all things very few complaints are heard, that is to say, in regard to receiving. But transmitting is another matter altogether. Just imagine for one moment that you are working with a two wire aerial 70 feet long, not forgetting and including the lead in. Then you are compelled to work on a wave-length of 180 meters, using 10 watts only. The greatest distance you can send under these conditions is 4½ to 5 miles.

In fairness to the authorities it must be taken into consideration that this country is quite different from America from many points of view. In the first place, this is a small island, and if the amateur was allowed anything like the power permitted in America there would be a very grave risk of interference with commercial stations, there being so many using short wave-lengths. I am firmly convinced that the matter has received every consideration by the authorities here and the restrictions that are so irksome to the amateur are quite necessary to prevent interference and other troubles and have been framed to protect the genuine experimenter rather than to annoy him. He, as a class, is sensible enough to recognize this, and is accordingly doing his best to help in the matter and make the best of things as they are. He is shown every consideration by the Post Office authorities, who take a lot of trouble over him. The fee of 10/- charged cannot possibly cover expenses.

The only grumbles one hears are from men who, previous to the war, were using fairly high power, and now find it impossible to use their old apparatus.

With regard to the number of stations from which it is possible to receive, I should imagine we have the advantage in England. In the first place we have the shipping, which is always interesting. There is never a minute, day or night, without getting something from ships around the coast. Sometimes there are so many that it is impossible to sort them out. Then there are the big coast stations, which are nearly always sending out something interesting. Paris (F.L.) is always to be picked up and is used as a test station by the amateur. It is like an old friend. If we are in doubt about a new detector, or if we have several valves we wish to compare, Paris is the one and only test, and it never fails us.

The more ambitious man who has a valve amplifier can be heard boasting of signals received from Rome, Washington, Annapolis, etc., and these stations can be heard very distinctly using three or four valves.

The reactance or regenerative circuit is very popular here. They give remarkable results on small aerials.

These circuits are also particularly suitable for telephony, and at the moment there is plenty of this to be heard. There is a regular service of aeroplanes between England and Paris. These aeroplanes are equipped with wireless telephony, are constantly in touch with land stations, and can be heard almost all day, working on a wavelength of 900 meters.

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FOR WIRELESS USE

Special Prices

Volts	Amps.	Price
6	20	$7.25
6	40	9.75
6	60	13.50
6	80-100	22.00

One year unconditional guarantee, free repair or a new battery at our option, shipped fully charged, ready for use.

Add $.50 for special crating.

Distributors—Jobbers—Dealers—write for discounts and exclusive territories. If your dealer hasn't it, send check or money order direct.

P. M. DREYFUSS

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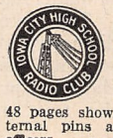

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Radio Clubs Everywhere have a special club pin. We make them to order, 25c to $10.00 each. 1922 catalog of 48 pages showing designs of Radio, School and Fraternal pins and rings FREE. Samples loaned to officers.

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In any length up to 25"

3" and 3½" Dia. 2½c per inch or fraction—5c per foot; 4" and 4½" Dia., 3c per inch or fraction—30c per foot; 5" Dia., 3½c per in., 38c per ft.; 3", 3½" and 4" has ⅛" wall; 4½" and 5" have 5/32" wall.

Postage extra—Shipping weight about 1½ lbs. per foot. Circular for stamp.

JEFFERY-CRAWFORD CO.

2173 Hillger Ave. Detroit, Mich.

ATTENTION:

Get our bulletin describing the Sterling Honeycomb coil mounting. Rubber binding posts 6 cents each. No. 14 hard drawn copper wire 45 cents per pound postpaid. Get our bulletin of other useful parts.

Sterling Radio Equipment Co.

2723 Cooper Avenue, Brooklyn, N. Y.

There are also some very interesting telephone experiments being conducted from the Marconi Station at Chelmsford. Speech is very clear and can be heard over a distance of 1,500 miles. Some interesting concerts have been given. On July 15th we had the great privilege of hearing Madam Melba sing. It was a wonderful night. Amateurs all over the country were prepared for this unique concert. The wireless clubs had in some cases provided themselves with amplifiers and loud speakers, and invited their friends and relatives to the concert. Some of the latter were rather sceptical at first, believing that a gramophone was concealed somewhere in the building, but after the first few bars they were convinced that it was indeed the famous Melba. No gramophone could possibly have given such clear and sweet notes. One enthusiast recorded her voice on a phonograph, thereby obtaining a lasting impression of these experiments which were such a striking success.

Recently this station has been speaking to the steamship *Victorian* on her voyage to Canada.

The concerts mentioned above were made up of various vocal and instrumental items, including in addition to Madam Melba, tenor solos, tenor solo with oboe obligato, piano solos, oboe solos, and selections by gramophone. More recently we had the pleasure of hearing the famous Danish tenor, Lauritz Melchoir.

The station at Poldhu in Cornwall is also using telephony, and I believe an attempt is to be made shortly to telephone on a 12,000 meter wave.

There is also a Dutch station which gives a concert twice a week, on Thursdays and Sundays, on a wave-length of 900 meters, so altogether we are well served with this wonderful new, at the moment shall we say, "toy."

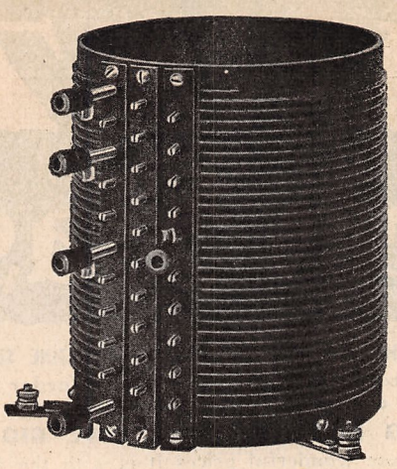
Frame aerials are becoming very popular here and if well designed and constructed they are a good second to our 100 feet outdoor aerials. It may be interesting to note that we are experimenting with Frame aerials with the reactance coils actually inside the frame aerial and not in the aerial tuning inductance. It is more or less experimental at present, but gives extraordinary results even at this stage.

There is a great quantity of wireless apparatus being sold by the Munitions Disposal Board, and the amateur can pick up real bargains. This apparatus was made for war work and is not very suitable for the amateur in its present condition as the wave-length is mostly 800 to 900 meters, but the prices at which these sets can be obtained makes them a bargain even if they are to be broken up for the condensers and other parts.

Now as regards books we are not so fortunate. The amateur is not catered to, to anything like the extent that he is in America. It is true that we have several publications such as the *Wireless World,* etc., but these are not to be compared with, for instance, RADIO NEWS, *Science & Invention,* formerly known as the *The Electrical Experimenter,* etc., which papers are very popular in this country and are certainly a great help to us, containing as they do so many helpful suggestions and ideas.

Our societies and clubs are now flourishing and promise to be very helpful. The Wireless Society of London is really a remarkable organization and numbers amongst its Committee and members some of the most distinguished scientists and engineers of the day, the President being Alan A. Campbell Swinton, F.R.S., M.Inst.C.E., M.I.E.E., M.Inst.Mech.E., and the Vice-Presidents including such men as Admiral of the Fleet, Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S., Le Général Ferrié, S. G. Brown, F.R.S., M.I.E.E., Dr. W, H, Eccles,

C W



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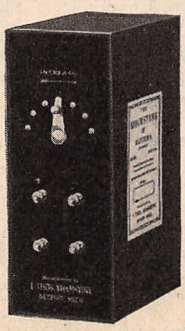

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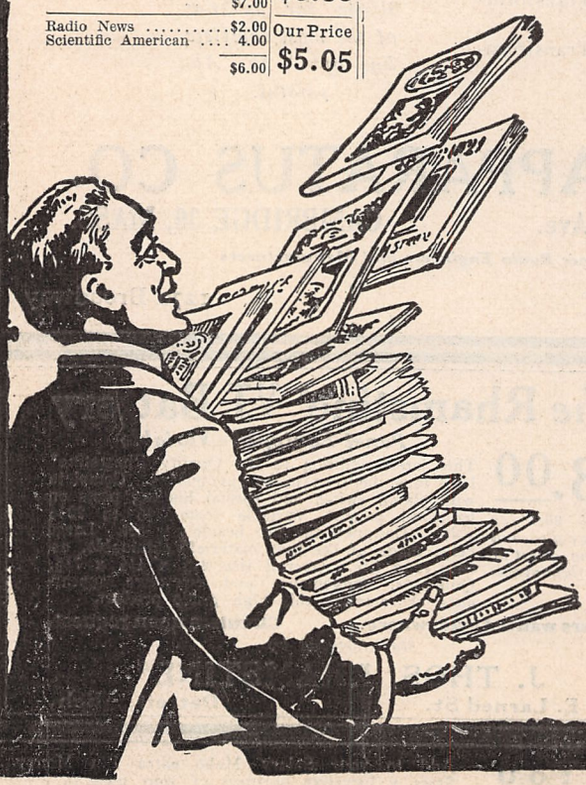

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A.R.C.S., Dr. J. Erskine-Murray, F.R.S.E., M.I.E.E., Dr. J. A. Fleming, F.R.S., M.I.E.E., and Prof. G. W. Osborn Howe, D.Sc., M.I.E.E. The Hon. Secretary is Mr. H. Leslie McMichael, who has done so much to help the amateur in this country, and I am pleased to note that he has recently been elected a member of the American Society of Radio Engineers. The list of members also contains many well-known names.

As regards the smaller clubs and societies, these are fairly numerous. The principal towns have at least one each, most of them being affiliated to the London Society.

With regard to the apparatus which is offered to us by the supply houses, there are very few firms here who trade in wireless apparatus only. The majority take it up as a side line and combine the sale with that of general electric goods, garden utensils, etc. They do not themselves manufacture and therefore they are at the mercy of the few who do, and it stands to reason that this class of salesman will not bother to improve his lines until forced to do so, and consequently the amateur suffers. Fortunately, however, there are just one or two firms who specialize in wireless apparatus and are always enterprising and up to date.

Altogether, we peg along, help each other as much as possible, and wait patiently for the RADIO NEWS, but we certainly envy the long receiving aerial you have the privilege of using in the States and the kilowatt of power too.

THE RADIO COMPASSES

By the side of the Western Ocean—they stand;
Silent, watchful, alone,
Listening for calls of wandering ships,
Wanting to help them home.

No question about the owner
Or if Bradstreet rates him high,
No mention of "what banner"
Streams upward toward the sky.

Alike is collier and cruiser,
Transport and old tramp ship,
From the Little Box at Cross Island, Maine,
Down to "The Mississip"

And there by the roaring breakers—they stand
All day and all night alone;
Listening for voice of wandering ship,
Wanting to help it home.

—*Radio Compass Bulletin, U. S. Navy.*

Odd Mexican Station

The accompanying picture is that of the transmitting panel of the Mexican station XAJ, located at Tampico, Mex. I was allowed to take this picture while visiting the station during my travels to Tampico.

This set is a conglomeration of various makes of apparatus, including some Mexican handiwork. A unique feature is the "variometer" type of aerial tuning inductance, built of hay-baling wire. Also the antique style of quenched gap, the gaskets of which I never could find, and which allow the spark to be observed jumping between the plates, within the gap. The receiver consists of a miniature loose couple that would go in an overcoat pocket, and galena detector, with Brandes phones. The normal range of this 2 K.W. station is about 300 miles at night, static permitting. Nevertheless this station handles volumes of business during its watch and is the bane of the existence of the operator in the vicinity. Its traffic is mostly shore work with Tuxpam XAL which he works for hours at a stretch, but the station is open to ship traffic during idle hours.

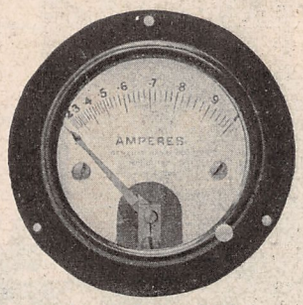
This picture may bring back memories to some of the "profs." who are constant read

20 MILES PER WATT

100 miles with a single 5-watt tube is becoming common operating practice. Quality, not quantity, is the secret of successful CW work. We seldom hear today a mere statement of miles worked. It is miles per watt.

For many years the General Radio Co. has been supplying the research and technical laboratories of the country with scientific radio apparatus. The citizen radio men today are demanding exactly this same high quality apparatus, and they have found that it is no more expensive than the average amateur radio appartus on the market.

We recommend that you consider General Radio apparatus the next time you make a purchase. It will save you money in the end. The three instruments illustrated here are selected as representative of our complete line. Ask your dealer to show them to you.



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Radiation and Filament Ammeter

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The hot wire ammeter is the universal meter for this service. It is adapted for d.c., low frequency a.c., or radio frequency. It can be checked at any time on d.c. and will be equally accurate on radio frequency. As its action depends on the fundamental I^2R law, it always measures actual effective amperes.

Our Type 127—3 in. Hot Wire Ammeter was made for exactly this service. It is made in front-of-board and in flush models, as illustrated, and in a variety of ranges.

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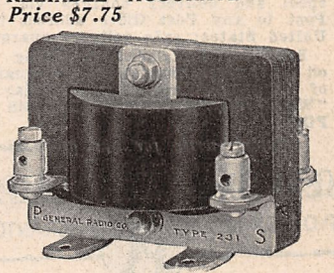

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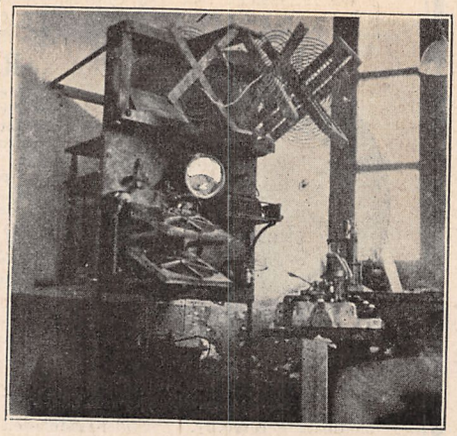
MACK'S RADIO SHOP
Ansonia Conn.

ers of RADIO NEWS and have probably worked XAJ, but never knew what it looked like inside.

In fact, it looks more like a home made set than anything else, but it "delivers the goods" just the same and at night can reach pretty far.

Contributed by FRED W. HILL.
Erstwhile WIQ, now KNC.

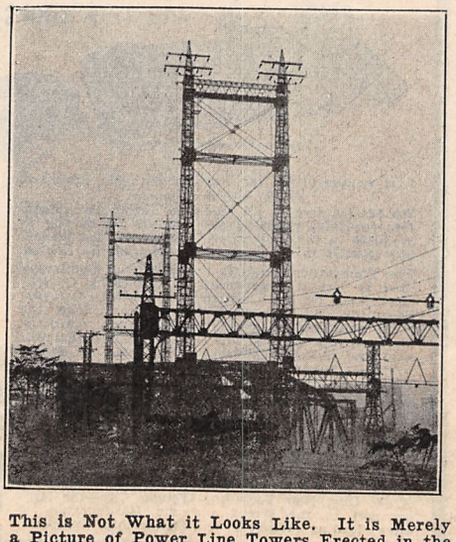


This Amateur-like Panel Set is XAJ at Tampico, Mexico.

THIS IS NOT THE MOST POWERFUL RADIO STATION IN THE WORLD!

Where the New York, New Haven & Hartford Railroad crosses the small Bronx River, in New York City, the array of steel towers and maze of high tension cables give one the impression that here must be some attempt to communicate with Mars by radio. Yet it is only for the purpose of spanning some fifty feet of the river that the railroad, which is electrified at this point, has had to raise its high tension cables on the tall towers here shown. In this manner the bascule bridge, right below the cable, can be swung open and there is no danger that some exceptionally tall masts of the ships might come in contact with the cables.

This gives a good idea of the complicated scheme necessary at the present time to support a line. If these towers were used for radio transmission, messages could be sent thousands of miles away. In the near future a good number of kilowatts will spread in the ether from such installations to run a craft in a distant part of the world, when the system under study at the present time, will make possible transmission of power by radio. Then, the wires will be used only for fishing purposes!



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Station Type as shown $30.00
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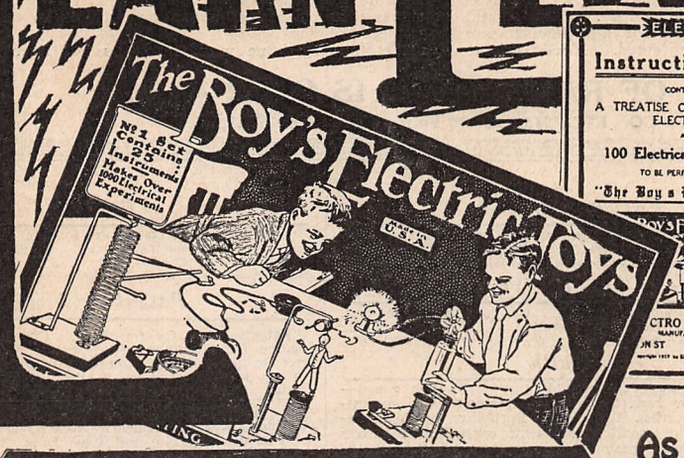
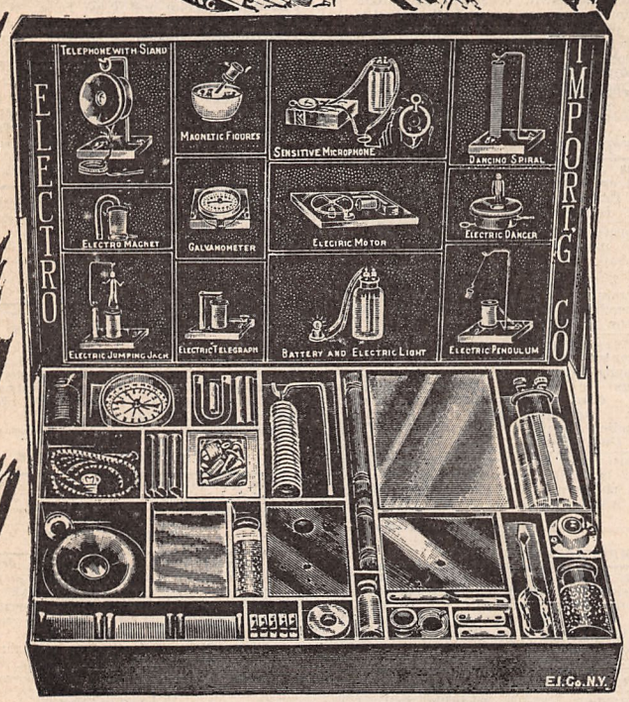


The BOY'S ELECTRIC TOYS



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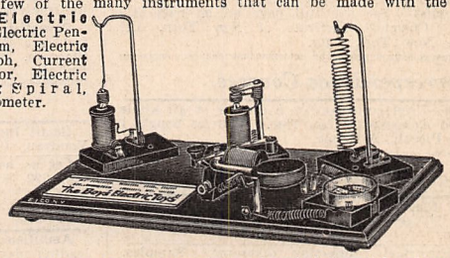
A Sample of What You Can Do With This Outfit

This illustration, made from an actual photograph, shows only a very few of the many instruments that can be made with the **Boy's Electric Toys:** Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer.



The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material are included: Chromic salts, lamp socket, mercury, core wire, iron fillings, three spools of wire, carbons, machine screws, flexible cord, wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc.

Teaches You How To Build Electrical Apparatus

THE BOY'S ELECTRIC TOYS' contains enough material to make and complete over twenty-five different electrical apparatus without any other tools, except a screwdriver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

Shipment guaranteed within 24 hours.

SEND NO MONEY

We have so much confidence in this set that we desire to ship it to you C. O. D. with the privilege of inspection. It does not cost you one cent to take a good look at the outfit, and see if it comes up to your expectations. If it does, pay the postman $7.50, plus shipping charges. If it does not, you need not accept it, and we will pay the return charges as well.

THE ELECTRO IMPORTING CO.
231 Fulton St., N. Y. City

ELECTRO IMPORTING CO.,
231 Fulton St., N. Y.

As per your advertisement, ship to me at once, C.O.D., the Boy's Electric Toys with privilege of inspection. It is understood that if I do not like the outfit I can refuse it.

Name .....

Address .....

City..... State.....

(RN 11-21)

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer you their most attractive specials in these columns.

Classified advertising rate six cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the January issue must reach us not later than December 10.

THE CIRCULATION OF RADIO NEWS IS OVER 46,000

EXPERIMENTER PUBLISHING CO. INC., 233 and 236 Fulton Street, New York, N. Y.

Agents Wanted.

Agents Coining Money selling Universal Gas Savers for every gas stove. Wonderful device. Cuts gas bills in half. Increases heat. Popular prices. 100% profit. Exclusive territory. Write quick. B. E. Moore, Gas Saver Company, Topeka, Kansas.

Big Money, Quick Sales, Fine Profits and steady demand selling Clows-Knit guaranteed hosiery direct from mill to wearers. All styles for men, women, children. Many making $3000 year. George Clows Company, Desk 57, Philadelphia.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

World's Fastest Selling Auto Specialties. Free advertisement. Our distributors making $45 to $70 a week. You can do the same. Join us to-day. Mashken & Company, 4509a S. Ashland, Chicago.

Automobiles.

Automobile Owners, Garagemen, Mechanics, Repairmen, send for free copy of our current issue. It contains helpful, instructive information on overhauling, ignition troubles, wiring, carburetors, storage batteries, etc. Over 120 pages, illustrated. Send for free copy today. Automobile Digest, 528 Butler Bldg., Cincinnati.

Motorcycles—Bicycles.

Don't Buy a bicycle motor attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 1611 Galesburg, Kans.

Books.

We Buy and Sell back issues of Radio Amateur News and Electrical Experimenter. Boston Magazine Exchange, 109 Mountfort St., Boston, Mass.

10 Cents Will Bring 6 Issues. Sample copy free. The Circulet, Portland, Connecticut.

Sex Books for Adults.—Illustrated catalog, 4c. Smetana & Co., Dept. 10, Ososso, Mich.

Handbook for Electricians and Experimenters, 20c. Joe Till berg, Proctor, Vermont.

Business Opportunities.

Substantial Manufacturing Corporation wants capable men to establish branch and manage salesmen; $300 upward necessary. Will allow expenses to Baltimore as explained. Address secretary, 343 St. Paul Place, Baltimore, Md.

Chemistry

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 369 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

Correspondence Courses.

Dollars Saved—Used correspondence courses of all kinds sold, rented and exchanged. List free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

Electrical Supplies and Appliances.

Blueprints of Electrical Connect ons for amateurs, sample and list, 25 cents. Atlantic Electrical Co., Old Orchard, Maine.

Blueprints.—Electrical connecting diagrams. Samples, 20c. Catalog free. Charles Chittenden, N3024 Matthews, Kansas City, Missouri.

Formulas.

Re-Blue Guns guaranteed formula mailed for $1. E. D. Simon, Dane, Wis.

Don't Throw Away Old Dry Cells. New Process, which recharges them to last twice longer. Process for Quarter. Western Supply, 2301 West 25th Street, Chicago.

For Advertisers.

Jacobus Sales Letters are "Go-Getters." $3.50 each. Jacobus Advertising Service, Irvington, N. J.

For Inventors.

Model Making by experts. Mechanical development a specialty. Satisfaction guaranteed. Scillitoe, 15 Frankfort St., New York.

News Correspondents

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Farms, Land, Etc.

Oklahoma Farms.—Write for free agriculture booklet. Board of Commerce, Shawnee, Oklahoma.

Games and Entertainment

Tricks, Jokes and Puzzles. Get our catalogue first. Agents Supply House, Binnewater, N. Y. Dept. ER12.

Health.

Pyorrhea (Rigg's disease—bleeding or swollen gums)—hundreds have been helped by "Pyorrdent" the successful home pyorrhea treatment. Purifying, healing, preventative. Full month's treatment, consisting of a very beneficial massage paste and an antiseptic tooth-cleansing paste to be used in place of your ordinary dentrifice, together with full directions for treatment. $1 postpaid. Or write for free booklet "R." Pyorrdent Mfg. Co., 439 Seventh St., Brooklyn, N. Y

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SB, Baltimore, Md.

Help Wanted.

Detectives Earn Big Money. Excellent opportunity. Travel. Great demand everywhere. Fascinating work. Experience unnecessary. Particulars free. Write, American Detective System, 1968 Broadway, New York.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665, St. Louis, Mo.

Be a Mirror Expert, $3-$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. R. Derr, Pres., 579 Decatur St., Brooklyn, N. Y.

Wireless Expert to invest money and services in fastest growing concern in central west. Six states exclusive territory for Grebe apparatus, three states Moorhead Tubes, also distributors for Kennedy, Amrad, Hipwell Batteries and others. Give detailed information and references first letter. Address: Arthur B. Church, President, Central Radio Company, Incorporated, 575 Grand Avenue, Kansas City, Missouri.

Radio Instructor—Must have executive ability and at least $500 to put into business. Wonderful opportunity for right party. Send photograph, recommendations, first letter. Central Radio School, 575 Grand Avenue, Kansas City, Missouri.

Instruction.

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 369 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

Play Mouth-Organ.—Complete, easy instructor, 25c. Elsea Co., Bowling Green, Ohio.

Become a Pool Champion through scientific methods used by America's and foreign champions. Write for information, 1174 Phelan Bldg., San Francisco, California.

Cornetists, Saxophonists, Trombonists, Clarinetists: Send for Free Pointers on weak lips—High Tones, Low Tones, Staccato, Jazzing. Mention instrument. Virtuoso School, Buffalo, New York.

Manufacturing

Small Induction Motor punchings and castings. Robert Vondrau, Preston, Ont., Can.

Let us be your factory! Write to-day. Logan Machine Co., 222 South Clinton Street, Chicago, Illinois.

Motion Pictures—Motion Picture Plays

Ambitious Writers—Send today for free copy, America's leading magazine for writers of photoplays, stories, poems, songs. Instructive, helpful. Writer's Digest, 691 Butler Bldg., Cincinnati.

Office Devices

Multigraphs, Typewriters, Addressing Machines, Duplicators, Folders, Sealers, Check Writers, Dictaphones, Office Equipment. Bought, sold, exchanged, rebuilt. Pruitt Company, 110 North LaSalle, Chicago.

Printing.

Labels, 60c per 1,000 up. Irvin J. Wolf, Station E, Philadelphia.

Everything Printed.—Long run specialists. Samples. Quality Printery, Marietta, Ohio.

Printing.—The Better Kind. May we quote on your next printing order? Olde Tye Press, 328 Richards Ave., Dover, N. J.

Your Name on 100 Cards with case, 60c postpaid. Log Cabin Printer, 289 So. Bayview Ave., Freeport, Long Island.

250 Letterheads, and 250 envelopes for $2.75. Write for price list and samples. Balkow Printing Co., Meriden, Conn.

Your Name on 35 Linen Cards and case, 20 cents. Agent's outfit free Big profits. John W. Burt, Coshocton, Ohio.

Personal.

Your Future Foretold.—Send dime, birthdate for truthful, reliable, convincing trial reading. Hazel Hause, Box 215S, Los Angeles, Cal.

Patent Attorneys.

Patents—Send for free book. Contains valuable information for inventors. Send sketch of your invention for free opinion of its patentable nature. Prompt service, twenty years' experience. Talbert & Talbert, 440 Talbert Bldg., Washington, D. C.

E. T. Brandenburg (former patent expert, Ordnance Division, War Department), Attorney-at-law and Solicitor of Patents, 927 Loan and Trust Bldg., Washington, D. C. Send sketch and description, or model of your invention for careful investigation at Patent Office and unbiased report as to patentability.

Millions Spent Annually for Ideas. Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc., 301 Patent Dept., American Industries, Inc., Washington, D. C.

Photo Developing.

Get Acquainted Offer—Mail us 20c with any size film or six negatives for development and six velvet prints. Twenty-four hour service. Fine work. Roanoke Photo Finishing Co., 324 Bell Ave., Roanoke, Va.

Miscellaneous.

For Sale.—Ice and snow remover for sidewalks and crossings. Cornelius Suydam, 26 Village Rd., Brooklyn, N. Y.

Artificial Marble, sanitary flooring instructions, ornamental casting, concrete plaster, papier-mache decoration, garden furnituure, statuary. Rubber-moulds, electro-metallurgy, particulars and 200 illustrations free. C. Mahler, Box 122 Huntington, N. Y.

Scenery for Hire.

Settings for all operas and plays. Catalog. Amelia Grain, Philadelphia.

Song Writers.

Song Writers!—Learn of the public's demand for songs suitable for dancing and the opportunities greatly changed conditions offer new writers, obtainable only in our "Song Writers' Manual and Guide," sent free. Submit your ideas for songs at once for free criticism and advice. We revise poems, compose music, secure copyright and facilitate free publication or outright sale of songs. Knickerbocker Studios, 319 Gaiety Bldg., New York.

Stammering.

Stammerers.—You can be permanently cured by my course of private individual lessons. Interesting booklet free. Samuel I. Robbins, 246 Huntington Avenue, Boston.

Stamps and Coins.

1000 Different Stamps, $3; 500, $1.25; 200, 25c; 100, 12c. Approvals. Michaels, 5602 Prairie, Chicago.

100 Stamps from 100 Different Countries, 36c. Lufbery, Yalesville, Conn.

100 Different Stamps, 15c. Brown Stamp, 111 Willow Wollaston, Massachusetts.

Telegraphy.

Telegraphy—(Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalog free. Dodge's Institute, M St., Valparaiso, Indiana.

Wireless.

Memorize Continental Code in one hour. Qualify quickly for mateur license. See our ad on page 458 this issue. C. K. Dodge.

Get Ready for the Good Radio Weather. Our VT circuits, each on separate blue print will enable you to try out a large range of proven hookups. Set of twelve, receiving or phone transmitting, 50c. Complete set of 24 for $1. The Plan Bureau, 1929 McCausland Avenue, St. Louis, Mo.

Western Elec. Aeroplane Microphones, with breast plate, straps, and cord, ea. $5; Bakelite tubing, 5" diam. at 6" 25c; 8", 35c; 12", 45c. 3 ft. length, $1. Litz wire, silk covered, 10-38, 35c; 100 ft., 25-32, 1c ft.; 36-30 D. S. C., 2c ft. Larvite resistance unit, 48,000 ohms, 50c. Complete parts for short wave regenerative receiver comprising hard wood cabinet, 18x7x6 with 3/16 panel to fit, 2 variometers, 1 vario-coupler, 3 Chelsea dials, switch lever, contact points, binding posts, etc., $18. 2 circuit jack with plug and cord, $1.10. Other bargains. Send for catalog. Haupt Electric Supply Co., 2442 Ogden Ave., Chicago, Ill.

(*Wireless continued*)

Short Wave Regenerative Sets, $38. Raskhodoff, 229 Eighth St., Troy, N. Y.

Regenerative Receiving Sets including variocoupler, variometers, rheostat and socket complete in cabinet, Thirty Dollars. Variocouplers, variometers, Four Dollars. Air dielectric receiving apparatus made to order. Stanford Electric, 4224 West Harrison St., Chicago.

Send for List one-half K.W. set complete, sockets, rheostats, amplifiers and etc. Joseph Fairhall, Jr., Machine Shop, Gilbert Street, Danville, Illinois.

Variable Condensers.—Plates, 4c; washers, movable, 5c dozen; stationary, 10c dozen. Samples, 10c. Shafts, 25c; parts for 23-plate, $1.40; 43-, $2.40; variometers and variocouplers, complete, $3.75 each. Also separate parts. Gravenstede, 84 Hancock Ave., Jersey City, N. J.

Audion Detector and Amplifier, V.T., 50 cents. Honeycomb coil mountings, 25 cents. Back mounted rheostats, 40 cents. Composition for molding your own knobs, panels, etc. 35c pound. Send stamp for particulars. Palmers Electrical Equipment Co., Palmers, Minn.

For Sale.—Telefunken and Marconi ½ K.W. 500 cycle quenched gap transmitters. Photos and particulars. Henry Kienzle, 501 East 84th Street, New York.

Make Your Own Receiving Coils, amateur, commercial, time. Full directions, blueprints, and sample coil, $1. Theodore Cutting, Campbell, Cal.

Stop! Look! and Act! V.T.'s. With each radiotron U.V. 200 V.T. detector or A-P Moorehead V.T. detector or radiotron U.V. 201 V.T. Amp. or A-P Moorehead V.T. Amp., we will supply free of charge your choice of either a Murdock V.T. socket improved contact type or a Remler Bakelite Smooth running rheostat latest type, radiotron U.V. 200 $5; radiotron amp. V.T. U.V. 201, $6.50; Moorehead A-P detector, $5; Moorehead AP Amp. V.T., $6.50; Remler Bakelite rheostat latest type, $1; Murdock V.T. socket, $1; Clapp-Eastham panel mounting rheostat of 4 ampere capacity or Murdock socket supplied free of charge with each $8 U.V. 202, 5-Watt radiotron power tube for C.W. or radiophone transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. All orders are filled within twelve hours and shipped postpaid and insured, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Special Sale of Parts for Radio Apparatus.—In order to liquidate a large stock we are offering at practically half price the following sets of complete units ready for assembly. This is an excellent opportunity to make a start in wireless. We have the following ready for immediate shipment, by parcel post prepaid, on receipt of remittance.Receiving tuner, 60c; 2000 meter loose coupler, $2; .0005 MF variable condenser, $2; crystal detector, 50c; No. 14 antenna wire, 100 ft. coil, 60c; transmitting helix, $1; ½" spark coil (complete assembled), $3.50; zinc spark gap with polished bakelite base, 50c; hand key, 25c; radio transformer 110 volts to 4000 volts, 125 watts, $5; 1000 ohm head phones single, $2; 2000 ohm head phones double, $3.75; strain insulators, 8c each; mica transmitting condensers .002 mfd $2; Kilbourne & Clark Mfg. Co., Seattle, Wash.

Vocaloud Loud Speakers.—Station type, $30; Laboratory type, $25; your choice of Saco Clad, Acme or Clapp-Eastham amplifying transformer free of charge with either type. Guaranteed. Postpaid, insured, twelve hour service. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Bargains.—Marconi receiving sets, Dubilier oil Leyden jars, rotary and quenched gaps, trnasformers, large spark coils, inductances, volt ampere frequency meters, motor generators, etc. One gasoline engine driven motor generator with or without suitable transmitter. Henry Kienzle, 501 East 84th Street, New York.

200 to 20,000 Meter Tuner in 30X8 oak cabinet, tapped honeycombs, Litzendrath dead end switches. 2.001 vernier variables. Lancaster Elec. Supply & Const. Co., Lancaster, Pa.

Baldwin Phones.—Reduced prices and? Why are Baldwin's so sensitive? Briefly, because—1. The small armature is pivoted and designed to act as a fulcrum when connected to the diafram by a small link. There is no tension or springing of metal as in ordinary receivers. 2. Four pole pieces of a single solenoid act upon both sides of a lightly balanced armature. 3. The force is concentrated at the exact center of a sensitive mica diafram, (identically the same as in all high grade phonograph reproducers.) Original, type "C"—$13.75. Improved type "E"—$15. Lighter, type "F"—$16.25. Single loud speaker unit, without cord type "C"—$6.80. Without cord type "E"—$7.50. With each pair of phones purchased, we will extend or give, free of charge, a one year's subscription to the Radio News. These well known head sets are absolutely guaranteed and subject to return in five days if not satisfactory. Postpaid, insured, twelve hour service. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Q. S. T. De Montebello Radio Shop.—¼ K.W. quenched transmitter, complete, $35. Write for particulars. We aim to please and stand for service. Mail orders filled. Remember us. Montebello Radio Shop, Montebello, Calif.

Enfield Radio Laboratories, West Upton, Mass. Order "B" Batteries at our special price for November, $1.60. We are distributors of all leading makes wireless apparatus. Premium with orders, $5 upwards.

Special Offer.—For a limited time we are giving everyone a chance to buy a reliable amplifying transformer of correct design at the lowest price on the market. We are offering the Clapp-Eastham amplifying transformer which gives results second to none. (Same as illustrated in recent issues of the Radio News), list price, $4, our price $3.45 postpaid. Immediate delivery, subject to return if not satisfactory. The Radio Distributing Company, Dept. R, Abilene, Kansas.

Constructing a Tube Set? If so, you need our bulletins listing your needs, at attractive prices: R. R. amplifying transformers, $3.50; plugs and jacks, $1.50; V.T. socket (new type), 60c; variometers (mahogany frame), $4.50; vario couplers, $3.75; dial type rheostat (Parkin), $1.75. Money back guarantee on all apparatus. Superior workmanship. All goods shipped same day as order received. We prepay all transportation charges and insure by parcel post. A postcard will acquaint you with our SERVICE. Don't delay getting our bulletins. They will save you money. "Unexcelled Service" our motto. The Citizens Radio Supply Co., P. O. Box 155, Mattoon, Ill.

Orders Filled in Twelve Hours. The Kehler Radio Laboratories.

Amateurs.—We buy and sell new and used Radio apparatus of all kinds. Write for particulars, The Radio Exchange, 804 Helen St., Sioux City, Ia.

(*Wireless continued*)

Attention!—50 vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalogue, which contains raw materials and parts in a greater profusion than any other catalogue. 15c in stamps, or coin, will bring the catalogue to you. Radio Specialty Co., 96-98 Park Place, N. Y.

To Amateurs in Towns of 100,000 or less: Listen: Are you interested in making money in your spare time? Write us, telling your age and standing with your local radio field. The information you furnish us will determine whether you are qualified to receive an interesting and reasonable proposition from us. Address Radio Dept., Federal Telephone & Telegraph Co., Buffalo, N. Y.

The Best at the Least.—Write for our attractive price list that will save you money on well known high grade apparatus, parts, radiophone, C.W. and vacuum tube accessories. Absolutely new. Enclose 10c for bulletins, if desired. The Radio Distributing Co., Abilene, Kansas.

Order Murdock, Clapp Eastham, DeForest, Acme, Firco, Radio Corp, Amrad and Westinghouse apparatus from Rocheleau's Store, Baltic, Conn.

Orders Filled in Twelve Hours. The Kehler Radio Laboratories.

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalogue. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal 75c prepaid. Send for yours to-day. Radio Specialty Company, 96-98 Park Place, New York City.

Condensers.—.001 Parkin Var. Unit., $1.50 postpaid. Leonard E. Moore, Durham, N. H.

N. & W. Radio Store.—Distributor for Klaus Radio Co., Greebe CR-1 regenerative receiver, $90. One radiotron uv 200 free with each set radiotron uv 200, $5; uv 201, $6.50. Remler B30 panels, $8; standard apparatus at retail price. W. R. Welton, 1020 Prairie, Mattoon, Ill.

Exchange.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 458 this issue. C. K. Dodge.

For Sale.—New Grebe CR3-A regenerator, $32. Ralph French, 116 Fowler Ave., W. Lafayette, Ind.

Must Close Out Everything at once—CRL Paragon and AGN-1 detector and one step, $85; Westinghouse receiver with two step in same cabinet, $90; Young and McCombs tuner and detector, $40; Acme 1 k.w., $25.75; Acme ½ k.w., $17; Acme amplifier, $9.85; No-stat parts, $5; DeForest coil mounting, $9; F-F Bantam Battery Boosters, $12.90; $7 modulation transformers, $5; $6 choke coils, $4.50. All above brand new. Also have Airplane receiver, good, small two tube phone; and large two tube phone at $100, radiates 1½ amps. Be quick. Verner Hicks, Marion, Ill.

Lopp Antenna constructed of stranded wire with well seasoned wood ready to assemble shipped prepaid on receipt of price. Four Dollars. J. E. McLaughlin. Room 308, 427 So. LaSalle St., Chicago.

Slide Rule—New, with magnifier; leather case; cube, reciprocal scales; instruction book. Ten Dollars. Hilbert Moore, 334 Main, Ottawa, Kans.

Will Trade—Gibson's mandolla, slightly used, worth $90, for wireless receiving apparatus. Joseph Rade, Arnold City, Pa.

Sale—Continuous wave and other wireless material. Write Walter Smith, Short Hills Ave., Millburn, N. J.

Sell—DeForest geared coil mounting, $6; DeForest vario-coupler, $3; New Turney Spiderweb inductance, $4; DeForest .001 variable, $10; .0005, $5; 2 W.E. 2 mf. condensers, $1.50 each; 2 new W.E. V.T. 2, $10 each; 2 Kenotron rectifier tubes, $6 each; short-wave regenerative in cabinet, $15; new Vibroplex, $10; 4,000 meter mahogany coupler, $7. Money orders. Sam'l H. Horowitz, Lenox 4880, 71 E. 96th St., N. Y.

2-LH's Record Radiofone, $35. Transmitting tube, microphone, etc., included. Photos, details on request. W. Halstead, Greenridge Ave., White Plains, N. Y.

For Sale—3 Honeycomb Coils & Triple gear panel coil mounting, $10; Brandes navy phones, $9; Western Electric phones, $10; 2 W.E. VT2 new, $9 each; Chelsea variable condenser, new, $3; 80 ohm phone, 50c; Omnigraph and 18 dials, $10; 1 Century buzzer, $1; Key & Century buzzer mounted on Bakelite, $4; 2 W.E. 1 M.F. condensers, 75c each. Adrian Kammeraad, 2511 S. Jessup St., Phila., Pa.

Cheap—Complete receiving set, $15. Write John Keene, Mont Clare, Pennsylvania. 3BIL.

Bargain—Mahogany, nickled, Navy Type loose coupler, $20; Audion panel with cabinet and bulb, $25. Write for particulars. Norvel Jones, 1250 West 45th Street, Los Angeles, Calif.

Acme 50 Watt C.W. Transformer, $13; J. J. N. variometer regenerative set, $20. Murdock aerial switch, $3. W. Halstead, Greenridge Ave., White Plains, N. Y.

For Sale—Ducks No. D22 mounted transmitting and receiving set; has 10-17 mile sending range. Excellent condition, $25. Also Ducks No. 1D, 100 watt step-down transformer, $5. Jack Jones, R.F.D. No. 2, Liberty, Missouri.

For Sale.—Short wave regenerative two stage receiving set, vocoloud, storage battery and C.W. apparatus. Must sacrifice. Owner leaving town. Fred Herrig, 862 Roscoe St., Chicago, Ill.

Grebe CR-3 For Sale.—Improved type, $50. Also detector and two step, with automatic filament control, $45. First $90 takes both. Good as new. Lester Bather, 220 East Warren, Detroit, Mich.

For Sale.—Renulife violet ray machine, $15. Howard Davis, Vandergrift, Penna.

¼ in. Spark Coil. key, gap, helix and D. P. D. T. switch, $6. D. Dadakis, 505 West 124th Street, New York City.

4000 Meter Navy Coupler, Cost $20.. Sell $11. Complete ½ K.W. transmitting set comprising power trans. O.T., mica condenser, rotary gap, key, protective device, at $35. M. C. Comp, 600 Blue Island Ave., Chicago, Ill.

Wanted.—DeForest triple geared mounting. Quick. C. Flichman, Jr., 3 Magnolia Ave., Hamilton, Balto., Md.

For Sale.—Wireless apparatus. Also Lionel Electric Train. Send stamp for prices. Harold Hogencamp, 623 22nd St., Paterson, N. J.

For Sale or Trade—One kilowatt Amrad quenched gap. Conrad Harington, 212 East 20th, Little Rock, Arkansas.

Wanted.—Omnigraph. Fifteen dial. Good condition. J. Hudlow, 21 So. 14th, Kansas City, Kans.

(*Exchange continued*)

V.T. Control Panel, new, unit type with dial, $5. Dubilier Transmitting condenser, swap or sell. J. J. Francis, 5230 Superior, Cleveland.

For Sale.—Complete 1" sending set (less key) and part of receiving set. For particulars write Harvey Frost, 2601 College, Fort Worth, Texas.

Experimenters.—Brand new never used Gilbert's Hydraulic, also Sound experiments. Cost $25, Nine Dollar money order takes both. Box 208, Pawtucket, R. I.

Absolutely Complete Panel Receiver, universal range. Never been used. Write for full description. Marvin Eder, Aurora, Ill.

Klitzen Gap, $20; Westinghouse small size charger, $14; Duck's Pancake oscillation transformer, $3; ½ K.W. Packard, $25. All almost new, fine condition. Jay Edmondson, Milton, Iowa.

For Sale.—Complete regenerative receiver, with aerial, etc. Corona typewriter. Good condition. Theron Eakins, Hico, Texas.

Duck's Arlington Transformer, twin cylinder Harley Davidson engine, good order. Want regenerative receiver variables. Roy Disheroon, 894 Park Ave., Hot Springs, Ark.

To Trade.—A pair of high powered French field glasses for a pair of Baldwin fones, or what have you? Apparatus must be in good condition. Wayman Davenport, Plainview, Tex.

Two Movie Cameras, Screw-cutting bench lathe. Joseph Dorothy, 517 West 148th, N. Y. C.

Selling Out.—Dunmore motor, fine adjusting rheostat, Benwood rotor and stationery electrodes, $25. ¼ K.W. Thordarson, $12; 10 ampere key, $2; bug, $2; Spauldings $15 boxing gloves, $8. D. Linehan, 934 Galt Ave., Chicago, Ill.

For Sale.—DeForest unit panel set, $40. Write for details. Clifford Lodder, 1105 Euclid Ave., Syracuse, N. Y.

For Sale.—Sprague 9 in. oscillating A.C. fan with two-way plug; new this season, $7. C. E. Lucas, Elkton, Md.

For Sale.—3500 meter audion receiving set, also a crystal receiving set, cheap. Ralph Miller, 136 Hudson St., Reading, Pa.

For Sale.—Arlington coupler, ½ K.W. Amrad quenched gap, radiotron detector, honeycomb coils. Homer Monto, 639 Oswald Street, Toledo, Ohio.

Bargain.—Slide trombone and case, cost $28, sell, $15. M.O. Raymond Moen, Colfax, N. D.

Slightly Used New York Wireless Institute Omnigraph, 15 dials, receiver, buzzer sound regulator and key, $25, or exchange for radio apparatus. John Maurer, Spring Valley, Illinois.

For Sale.—Phone set, $100; receiver containing regenerative tuner detector and two step amplifier, $75; variometer receiver, $30; honeycomb tuner with coils, $50; detector and two step, $35. Want Magnavox. Write F. Mann, 327 4th Ave., New York City.

Sale.—½ K.W. transformer coil for spark transmitting, $9. Wilson McClanen, 6122 Musgrave St., Germantown, Philadelphia.

For Trade.—Exhibition model Edison projecting kinetoscope, complete with arc light and rheostat. In good mechanical condition. Cost $125. Want amateur wireless transmitter complete and short wave tuner. L. M. Matthews, McClure, Ill.

National Radio Institute Natrometer, $15.. Foster Lawrence, Eustis, Florida, Box 481.

For Sale.—A few good audion detector cabinets, new, with bakelite panel, $7.50. R. E. Lindquist, 4745 N. Campbell Ave., Chicago.

Rotary Spark Gap, almost new, used only one week, oscillation transformer, $4; also new. Mr. J. E. Lowden, 321 N. Main St., Ansonia, Conn.

Bargains.—New Boston Key, $6; $45 3 K.W. Rotary, $20; Army key, $2.50; Murdock 3000 ohms, $4; Y 2-gal. Leyden Jar, $2; 4 wire 50 ft. aerial, $2; Marble base aerial switch, $6. Guaranteed, would trade. Francis McKee, Weiser, Idaho.

1 K.W. in good condition, will sell for $25. J. E. Lowden, 321 N. Main, Ansonia, Conn.

Hawkins Electrical Guides, new, $8; American Technical Society, 5 volume set on Automobile Engineering, $10; R & M Ac-Dc 8 in. fan, new this season, $5; Brande new Navy phones, $9; 600 V 100 A lightning switch, $3; 400 ft. 7 strand aerial wire in two pieces and two 10 in. insulators, $4; Clapp Eastham 43 plate condenser and Clapp Eastham buzzer, $4.50; Arnold 3600 meter coupler, Grebe .005 mf. condenser & grid leak, cost $3.80 new, Murdock socket, Paragon rheostat and B battery, all for $15; Mascot key and $3.50 telegraph sounder, both for $3.50. C. E. Lucas, Elkton, Md.

Paragon RA-10, almost new, $75. Detector and two step amplifier panel to match Paragon, $40. R. Stewart No. 5 Cron Flats, West Lafayette, Indiana.

For Sale.—¼ H.P. motor, 110 V.A.C. Almost new, $20. Frank Macfarlane, 1123 E. 47th St., Chicago.

For Sale or Exchange on good Typewriter. Trans. & Receiving instruments all like new, value about $130. For particulars write Edgar F. Moyer, 561 Broad St., Emans, Pa.

Amrad Induction Coil, 32 volt recently overhauled at factory, $12.50. Two step amplifier shop model consisting of formica panel, Acme transformer, Remler sockets, Paragon rheostat, two jacks and necessary binding posts, $18. Tusca C.W. inductance, type 182, $7. Type S.S. Knapp dynamo, $4. DeForest detector type P402, $10. All apparatus sent C.O.D. Ray Thompson, Canton, S. D.

Will Trade new automatic pistol for good receiving set, McHaney Studio, Paragould, Ark.

For Sale Cheap.—Winchester single shot 22 rifle; never used. Particulars 2c. D. Nelson, Beacon St., Lowell, Mass.

Sell.—15 watt phone, mounted or separate, $60; 500 watt C.W. transformer, $20; honeycombs,. Murdock 55. $3.50, and more. Write for list. Ed Page, 8BSS, Baldwinsville, N. Y.

For Sale.—Short wave set, phones, spark coil transmitter, $55. Tuska coupler, $5. Andrew Potter, Westminster Ave., Syracuse, N. Y.

For Sale.—3 step amplifier and detector Acme transformer plugs and jacks panel 20" x 11", $60. Short wave regenerative variometer and coupler in cabinet, $35. Sears Navy coupler, $12. H. Pearson, Jr., 818 Ingleside Pl., Evanston, Ill.

Fall.—New Gould storage batteries, D. C. motor audiotrons Marconi jar, VT-2, set switch, rotary. Radio 8BQ, Danville, Penna.

(*Continued on page* 470)

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(*Continued from page 469*)

(*Exchange continued*)

For Sale.—Regenerative with detector combined, $45; NAA coupler, $6; relay, 75c; Murdock load coil, $3.50; Standard det., 75c; Murdock trans. con., $2.50. Mounted honeycombs 150, 50, 35, 25 also unmounted 500, 300, 20% off DeForest catalog. Armstrong regenerative $30. Write to B. W. Smith, Loveland, Ohio.

Triple Geared Honeycomb Receiver, 150-20,000, including twelve coils and audion, $70; tapped coil receiver, 600-20,000 including audion, $35. Smith, Box 205, Williamsport, Pa.

A Real Bargain.—A DeForest two stage amplifier Type P200, $40. Special designed short wave regenerative DeForest set and audion control in oak cabinet, and complete set of honeycomb coils. All new. Write for price and information. Vincent Rosso, P. O. Box 415, Plaquemine, La.

Wanted.—Omnigraph, state price and condition. Jerry Siggins, Box 92, Twin Falls, Idaho.

Look!—6 volt 60 amp. hour radio storage battery used 4 months. First $14 money order gets it. Arthur Studer, Box 117, Washingtonville, N. Y.

For Sale.—One Grebe special type CR-3, $50. First class condition. A. F. Wineburgh, 246 West End Avenue, New York City.

Radiofone, Complete, $100. Tubes, microphone, 250 volts direct from 110 A. C. Working condition. Range 50 miles. Z. Miller, 87 Gordon St., Perth Amboy, N. J.

For $1, 250 ft. of No. 22 seven strands tinned copper wire. C.W. set for sale. Send stamps for other bargains. Mack's Radio Shop, Ansonia, Conn.

Tungar Bulb Rectifier sale or exchange. New. Charges storage battery from A.C. Van Slyck, Ironwood, Mich.

Swap.—General Radio wavemeter. Want 2 stage amplifier with bulbs. Schuck, 1411 Ave. A, N. Y. C.

Bargain.—Complete ½ kilowatt spark set, $25. Will sell parts. Leslie Huntwork, 93 Murphy Ave., Pontiac, Michigan.

Quality.—Arnold condenser, list $24. Pair No. 55 Murdocks, $5.50; DeForest detector, $2.10; fixed condenser, 75c. First money order for $22.50 takes above slightly used apparatus. J. Hammett, 136 Water St., New York.

Sell.—Omnigraph No. 2Jr, 5 extra dials, $10. Roger Curtis, Chevy Chase, Md.

Short Wave Regenerative Receiver and audiotron control panel, $15; Audiotron, new, $4; Murdock variable, .0005, $5. $20 takes all. T. Marc-Aurele, Tortville, Conn.

Sell New Grebe C.R. 5 Receiver. Perfect shape, $66. Best thing on the market. Box 208, Pawtucket, R. I.

For Sale.—8 ANP's, ½ kilowatt Packard transformer, $13; rotary spark gap with motor, $7. Francis Furlong, 733 River St., Ypsilanti, Mich.

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Will Trade multiwave cabinet for standard short wave set. Cabinet 18"x6½"x6½". Two VC's .001 Bakelite panel. 12 H.C. & D.L. coils. E. H. Reeves, 1237 E. 100th St., Cleveland, Ohio.

H. Powell-Rees Receiver, copies around world, complete $175.00 or best offer for immediate sale. Smythe, Thornbury, Ontario.

Sell. Clapp-Eastham Regenerative 3RF, $25. Radiotron detector, $4. Hawkins electrical guides, $7. M. Swanson, Lancaster, N. Y.

For Sale.—Short wave regenerative set in mahogany cabinet, $20; complete 2 inch spark coil transmitter, $15; 6000 meter navy coupler, $8; 15,000 meter loading coil, $5; many other bargains. List. Lester F. Wertz, Temple, Penna.

For Sale or Trade.—One complete Grebe C.R.3 receiver with Audiotron & Brandes fones, Packard ½ K.W. with oil condenser. Trade for "C" melody saxophone in first class condition. John Amis, 915 Lincoln, Topeka, Kansas.

For Sale.—Detector two step cabinet; ½ K.W. spark transmitter; 70 mile Radiophone. All new. Cash talks. Write, J. Wm. Anderson, East Tawas, Mich.

Meteor 2000 M. Coupler, $4.50; ¼ K.W. Thordarson, $8.75. Emory Bancroft, Blissfield, Michigan.

Trade—A $70 canoe, good condition, or Yale motorcycle, for variometer regenerative, two step with bulbs, 1 K.W. transformer with gap or Magnavox. Alfred Beech, Sleepy Eye, Minn.

IXZ's Spark Set., 1 K.W. Acme Dubilier .007, Hyrad gap Westrad O.T. accessories, perfect condition. Frank Bryant, Clark University, Worcester, Mass.

Bargain.—2 Duck variometers; 1 Radisco variocoupler (new); 2 Clapp-Eastham .0003 variable condensers; 1 Murdock .001 condenser; 3 dials and knobs; cost $33.15, sell for $25, or make offer. All apparatus guaranteed. 1 DeForest vario-coupler and mahogany cabinet free. Wayman Davenport, Plainview, Texas.

For Sale—Detector, two step, $65. Complete bulbs, batteries, phones; also condenser, and other radio material, cheap. A. J. Ellsworth, Fowlerville, Mich.

Regenerative Receiver including detector unit, $30. E. Hansen, 998 Putnam Ave., Brooklyn, N. Y.

Best Offer takes new Grebe CR-5 receiver and accessories. Milton Jacobs, 428 Fourth Ave., New York.

For Sale.—Duck Navy coupler, $10; Connecticut variables (2), $3 each; DeForest honey combs, 50, $1; 100, $1.25; 150, $1.50; 400, $1.75; 500, $2; 600, $2.50. Loading inductance, $5. All above goods in perfect condition. Postage paid. Raymond Naser, Anacortes, Wash.

Sell.—Two crystal receiving sets with phones, ten dollars each. Two spark sets complete, ten dollars each. One honey-comb receiver with audion unit complete without phones or bulb, $30. William O'Kane, Durham, N. H.

New.—Radio Magnavox, $32.50. Sent C.O.D. for your inspection. Act quick, this is your chance. Joe E. Randle, P.O. Box 198, Hopkinsville, Ky.

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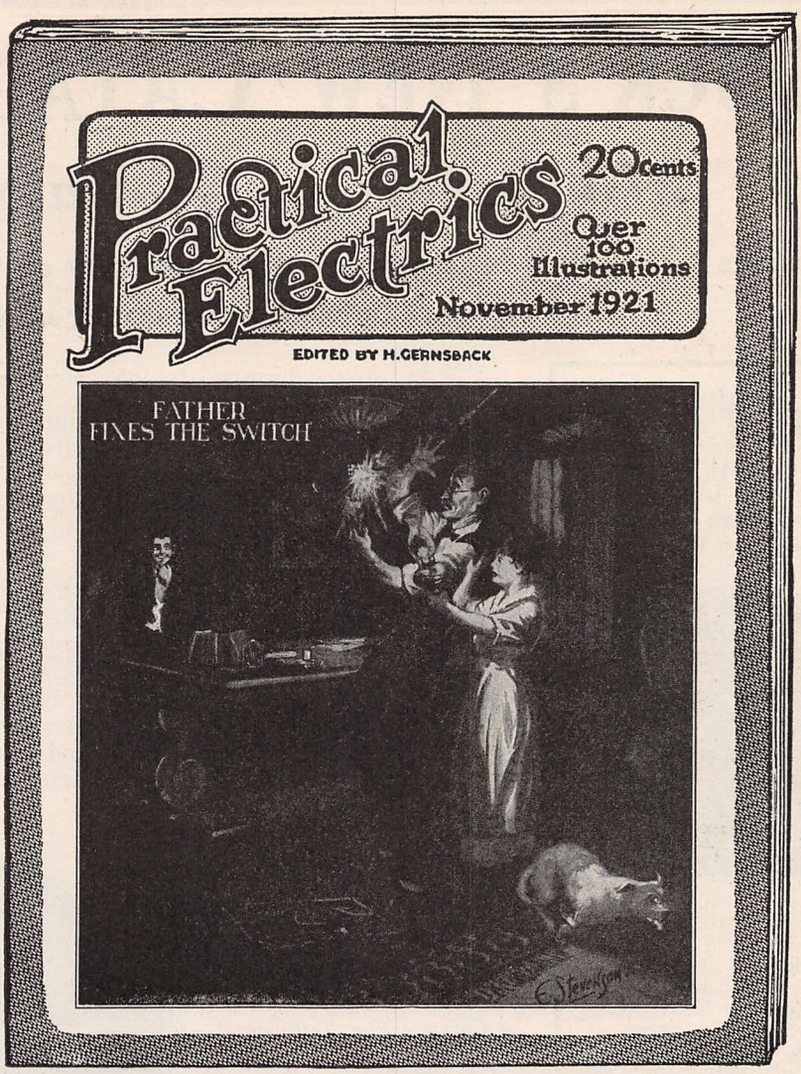

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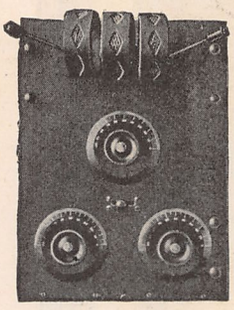

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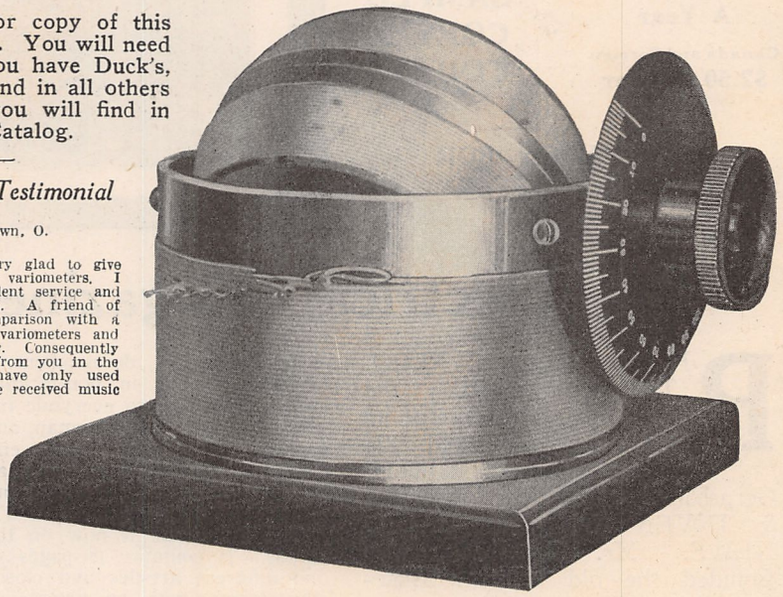

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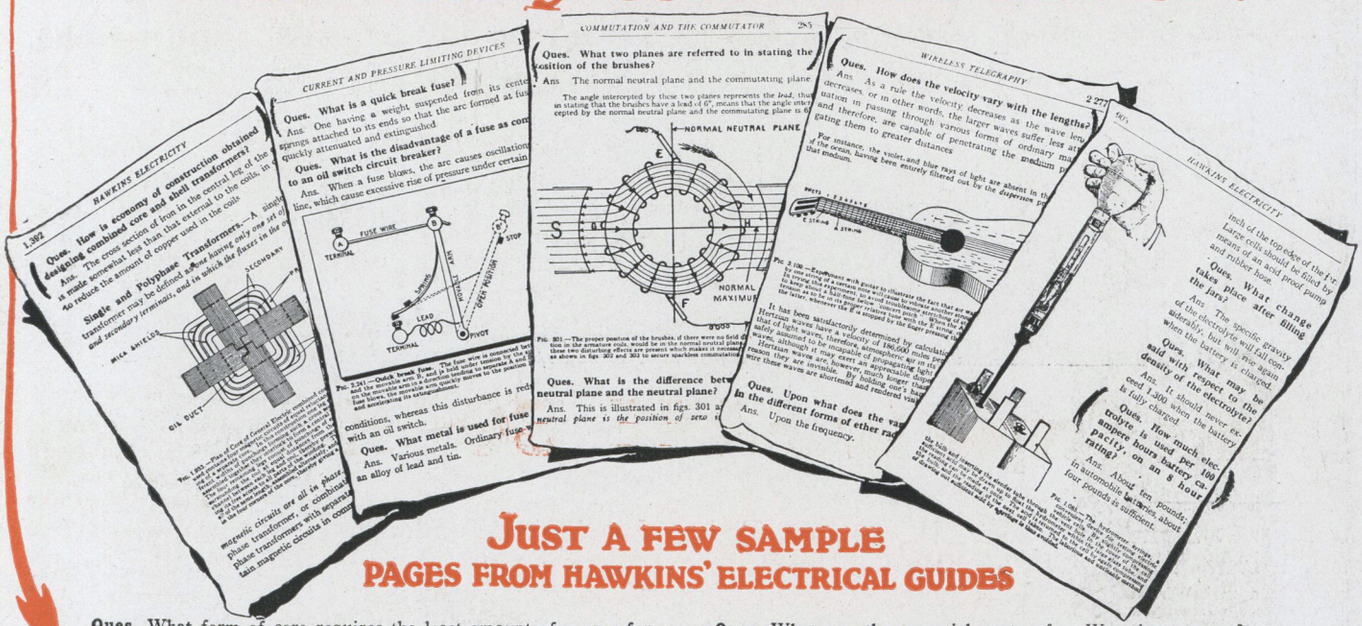

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Ques. What error is introduced in measuring the pressure of a battery with an ordinary voltmeter?
(For answer see Guide No. 2, Page 467)

Ques. What is a kick box?
(For answer see Guide No. 3, Page 776)

Ques. What is a compositely excited alternator?
(For answer see Guide No. 4, Page 1191)

Ques. What is the character of the constructions of three phase transformers;
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(For answer see Guide No. 7, Page 2148)

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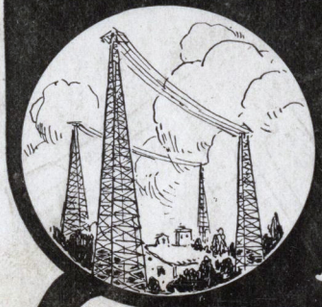

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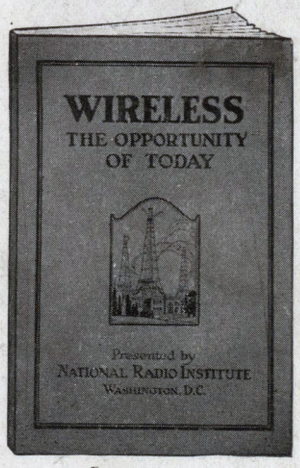

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